software and hardware for the Bally Arcade

-a technical description

a dave nutting associates design

a division of bally manufacturing corporation

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LIST OF ILLUSTRATIONS

HOME VIDEO GAME SYSTEM

This documentation describes the Bally Home Video Game System. The description begins with a discussion of the major sub-sections of the system. Following this, each sub-section is presented in greater detail, with detailed particulars, such as calling sequences and resource use.

The major sub-sections of the system are:

The User Program Interface...which allows cassettes to reference the system routines through a standard interface. Includes an interpreter.

The Screen Handler...a complex of routines for creating screen images. Includes facilities for initialization, pattern, and character display, co-ordinate conversion, and object vectoring.

The Interrupt Processor...decrements timers, plays music, and produces sounds.

The Human Interface...reads keypad and control handles, inputs game selection and options.

Math Routines...a package of routines for manipulating floating BCD numbers.

USER PROGRAM INTERFACE

The User Program Interface (UPI) is a set of procedures and conventions, which are utilized by a cassette program to access the facilities provided by the home video game system. By adhering to these conventions a cassette program will be system independent, thus allowing improvements to be made to later versions of the system and on-board games, while maintaining upward compatability.

The basic rule for using the UPI is:

> With exception to the system DOPE vector, no cassette should ever address system ROM directly, or expect a given cell to always equal a certain value

The mechanism for calling a system routine is:

```
        RST     56
        DEFB    (routine # + option)
```

where routine number is an even number specifying which sub-routine to transfer to, symbolic identifiers, which are equated to routine numbers, are provided in HVGLIB.

Option is used to specify how arguments are being passed to the system routine. If option equals zero, the arguments are presumed to exist in CPU registers; if option equals 1, the arguments are taken to follow in line after the routine number/option byte. These arguments are loaded into the CPU registers automatically before the called routine is entered. The arguments required by each system routine are given in the routine's detail documentation.

The SYSTEM macro generates the sequence previously mentioned with option = Ø:

```
        SYSTEM  (routine #)
```

(example)

```
        SYSTEM  FILL
```

The SYSSUK macro generates the sequence previously mentioned with option = 1:

```
        SYSSUK  (routine #)
```

Frequently it is desirable to string several system routine calls together. If four or more calls follow in sequence, it is more efficient to utilize the interpreter. By using the interpreter we void the overhead of the RST 56 instruction by expecting a call index to immediately follow the call index or arguments used by the previous system routine.

Special call indexes are used to enter and exit interpretive mode:

Example:

```
        SYSTEM  INTPC               ;BEGIN INTERPRETING
        DO      FILL                ;DO FILL ROUTINE
        DEFW    NORMEM              ;STARTING AT TOP OF SCREEN
        DEFW    92*BYTEPL           ;CONTINUING FOR 92 LINES
        DEFB    Ø                   ;FILLED WITH ZEROES
        DO      CHRDIS              ;DO CHARACTER DISPLAY ROUTINE
        DEFB    Ø                   ;Y-AXIS POSITION OF CHARACTER
        DEFB    1Ø                  ;X-AXIS POSITION OF CHARACTER
        DEFB    8                   ;OPTIONS-PLOP,1Ø-ON,ØØ-OFF
        DEFB    'A'                 ;CHARACTER TO BE DISPLAYED
        EXIT                        ;EXIT INTERPRETER
```

A block of call indexes have been set aside for the internal use of cassette programs. If a negative call index is encountered, the user's macro routine address table and argument table are utilized. The user is responsible for storing the addresses of these tables into dedicated system RAM cells.

All UPI routines are re-entrant.

Registers which are not defined as containing output parameters will not change.

SYSTEM ROUTINE CONVENTIONS

A system routine is coded like a conventional machine language subroutine, with the exception that output parameters are not passed through registers, but rather through the context block.

The context block is created by the RST 56 call. The user's register set (AF, BC, DE, HL, IX, IY) is pushed onto the stack. Register IY is set to point at this stack frame. Thus a copy of the input arguments exists in RAM which the system routine may refer to as needed. These arguments are also present in the registers when the system routine is entered; hence it is only necessary to refer to the context block when one has clobbered an input argument.

An output argument is returned to the caller by setting it in the context block. If a register was changed, but the associated cell in the context block was not, then the register will have it's old value on return. Thus a system routine is free to use any of the registers it needs without concern to saving and restoring. Moreover, the user can assume that no registers will change except those defined as returning an output argument.

The following illustration describes the context block and equates provided in HVGLIB for each field.

Four tables are used by the UPI in the control transfer process. The first two tables gives the routines starting address indexed via call number. The systems table is named SYSDPT. The user may extend this table by storing the address of his extended table into USERTB, USERTB+1. This address should point 128 bytes before the first entry.

The other two tables describe what in line arguments a call that specifies in line arguments should expect. This table gives a one-byte bitstring, also indexed via call number. The systems name is MRARGT, the user's address is in UMARGT, UMARGT must point 64 bytes ahead. Arguments must follow the call in a specified order.

Note that the context contains additional information not shown. This information exists both above and below the context. User programs should never use this information or even assume that it exists. The user should only address this area by using IY.

DISPLACEMENT	MEMORY CELL	EQUATE NAME
0	IY	CBIYL
1		CBIYH
2	IX	CBIXL
3		CBIXH
4	E	CBE
5	D	CBD
6	C	CBC
7	B	CBB
8	FLAGS	CBFLAG
9	A	CBA
A	L	CBL
B	H	CBH

CONTEXT BLOCK FORMAT

IN LINE ARGUMENT MASK TABLE ENTRY
TABLES MRARGT and UMARGT

If a bit corresponding to a register is set, the register is loaded. The order in which the arguments must appear is:

IX (L then H), E, D, C, B, A, L, H

If an argument isn't specified, it is omitted.

7	6	5	4	3	2	1	0
H	L	A	IX	B	C	D	E

UPI INTPC

BEGIN INTERPRETING

Calling Sequence:	SYSTEM INTPC
Aruguments:	None
Notes:	None
Description:	

See UPI description for explanation of interpreter

UPI XINTC

EXIT INTERPRETER

Calling Sequence:	EXIT
Arguments:	None

Description:

This code causes the interpreter to exit. Execution of machine instructions proceeds at the following location.

Restrictions:

This routine should only be called using the interpreter. A direct system call would produce unpredictable (and catastrophic) results.

UPI RCALL

CALL ASSEMBLY LANGUAGE SUBROUTINE

```
Calling Sequence:       DO      RCALL
                             or
                        DONT    RCALL
                        DEFW    (routine address)
Arguments:              HL=address of routine to call
```

Description:

RCALL may be used to call any assembly language subroutine from the interpreter. When the subroutine returns, interpretation proceeds at the next instruction.

When the assembly language routine receives control, HL will point at the routine's starting address; the other registers will contain their current values. Any changes made to the register set by the subroutine will not be passed along. To pass an output parameter, the subroutine must alter the context block, which is pointed at by IY.

Restrictions:

Assembler routine must not destroy IY.

```
Example:                DEFB    RCALL
                        DEFW    CLRAC
                           .
                           .
                           .
                CLRAC:  XOR     A
                        RET
```

UPI MCALL

CALL INTERPRETER SUBROUTINE

Calling Sequence:

```
SYSTEM  MCALL
     or
SYSSUK  MCALL
DEFW    (routine address)
```

Arguments: HL=Subroutine Address

Description:

MCALL is used to call an interpreter sequence as a subroutine. MCALL may be used from machine language as well as within an interpreted sequence. Calls may be nested infinitely, limited only by stack space (4 bytes per call)

To exit the interpreted subroutine, use MRET.

Example:

```
        SYSSUK  MCALL
        DEFW    ZAPALL
             .
             .
             .
ZAPALL: DO      FILL+1          ;DO FILL
        DEFW    NORMEM
        DEFW    ØFFFH
        DEFB    Ø
        DO      MRET            ;GO BACK TO CALLER
```

UPI MJUMP

INTERPRETER JUMP

Calling Sequence:

```
DO      MJUMP
    or
DONT    MJUMP
DEFW    (goto address)
```

Arguments: HL=Go to address

Description:
The current interpretive program counter is set to the contents of HL. The next instruction is fetched from that address.

Restrictions:
MJUMP must be called from the interpreter. The targets of all JUMPS must also be interpreted sequences.

Example:

```
        SYSTEM  INTPC       ;ENTER INTPC STEP
           .
           .
           .
        DO      MJUMP       ;JUMP TO END OF
        DEFW    END         ;INTPC STEP
           .
           .
           .
END:    DEFB    XINTC       ;EXIT INTERPRETER
```

UPI MRET

RETURN FROM INTERPRETIVE SUBROUTINES

Calling Sequence:	DO	MRET
Arguments:	None	

Description:

MRET causes execution to proceed at the instruction following the corresponding MCALL instruction. See MCALL for more information.

SCREEN HANDLER

The screen handler is a group of routines for generating frame buffer images. Included are entries for filling sections of the screen with constant data, the animation of figures, and the display of alpha-numerics.

Many of these routines utilize the MAGIC functions provided by the custom chips. Since the status of these chips cannot be context-switched, many of these routines are not re-entrant. The user is responsible for preventing conflicts. This can be done by disabling interrupt, or implementing a semaphore.

SCREEN SETOUT

SET DISPLAY PORTS

Calling Sequence:	SYSTEM SETOUT
	or
	SYSSUK SETOUT
	DEFB BLINE*2
	DEFB HORIZX/4
	DEFB INMOD
Arguments:	A=Data to output to INMOD (port EH)
	B=Data to output to HORCB (port 9H)
	D=Data to output to VERBL (port AH)
Output:	None
Description:	Outputs above data to ports See hardware writeup for discussion of above ports.

SCREEN FILL

FILL A CONTIGUOUS AREA WITH CONSTANT

Calling Sequence:	SYSTEM	FILL
	or	
	SYSSUK	FILL
	DEFW	(first byte)
	DEFW	(number of bytes)
	DEFB	(data to fill with)
Arguments:	A =Data to fill with	
	BC=number of bytes to fill	
	DE=address to begin filling at	

Description:

This routine sets the memory range DE to (DE+BC-1) to the specified constant.

Notes:

Fill can be used for screen clearing, or initialization of scratchpad RAM. It is re-entrant.

SCREEN RECTAN

PAINT A RECTANGLE

Calling Sequence:

```
SYSTEM  RECTAN
     or
SYSSUK  RECTAN
DEFB    (X co-ordinate)
DEFB    (Y co-ordinate)
DEFB    (X size)
DEFB    (Y size)
DEFB    (color mask)
```

Arguments:

A =Color mask to write rectangle with

B =Y-size of rectangle in pixels

C =X-size of rectangle in pixels

D =Y co-ordinate for UL corner of rectangle

E =X co-ordinate for UL corner of rectangle

Description:

A rectangle of specified size of color mask is written at X,Y. RECTAN uses the MAGIC functions and is not re-entrant.

Example:

Put up a 3 X 4 rectangle of color 2 at 15,13.

```
DO      RECTAN
DEFB    15
DEFB    13
DEFB    3
DEFB    4
DEFB    1Ø1Ø1Ø1ØB
```

SCREEN WRITE ROUTINES

Virtually every video game involves the manipulation of animated figures. These figures are composed of patterns which are arbitrary pixel arrays. The write routines are used to transfer such patterns to the screen.

Five hierarchical levels of call are supported. The levels differ in the amount of preprocessing required by the user before calling. The highest level assumes that most of the parameters reside in a standard data structure, while the lowest level presumes that all arguments are in registers with all attendant transformations (such as relative-to-absolute conversion) already accomlished. The five levels are:

(1) Write from a Vector
(2) Write Relative
(3) Write Variable Pattern
(4) Write
(5) Write Absolute

Two transformations of the pattern may be performed prior to writing. They are FLOP and EXPAND. FLOP is mirroring the pattern on the X-axis. EXPAND is the translation of a 1-bit per pixel pattern into a 2-bit per pixel pattern. Since many patterns are only two-color, this allows for more efficient pattern storage. FLOP and EXPAND can both be done at the same time.

Three writing modes may be used. They are PLOP, OR, and XOR. PLOP is a conventional store into RAM. If OR is optioned, the data being written is ORed bit by bit with whatever was already there. Similarly, if XOR is set, the pattern is XORed with that beneath. Use of OR or XOR takes slightly longer since a read before write must be performed.

Note that ROTATE is not currently supported in software due to space considerations.

STANDARD CALLING SEQUENCE

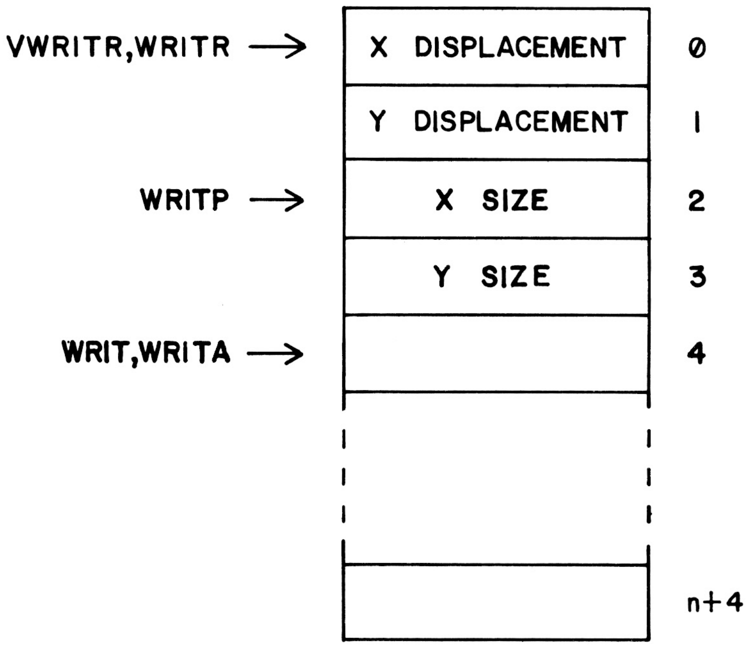
Every write routine uses a subset of the following argument/register assignment:

A = Magic Register
B = Y Pattern Size
C = X Pattern Size in Bytes
D = Y Co-ordinate (Ø - 1Ø1)
E = X Co-ordinate (Ø - 159)
HL = Pattern Address
IX = Vector Address

PATTERN REPRESENTATION

The higher the level of the write routine, the more ancillary information is stored with the pattern. The following diagram shows what each level expects. Any bytes of lower address than the pointer for a given level, need not be specified.

Use Restrictions:
None of the write routines are re-entrant due to Magic Register/Expander clobber.



SCREEN WRITE VWRITR

WRITE RELATIVE FROM VECTOR

Calling Sequence:	SYSTEM VWRITR
	or
	SYSSUK VWRITR
	DEFW (vector)
	DEFW (pattern)
Arguments:	HL=Pattern address
	IX=Vector Address
Output:	DE=Absolute address used
	A =Magic register used

Description:

The co-ordinates and magic register are loaded from the specified vector. (See vector routine document) The relative co-ordinates stored with the pattern are added to the co-ordinates from the vector. The pattern size is also taken from the pattern and writing proceeds.

Notes:

If expansion is to be done, the ON/OFF color must be set by the user before calling VWRITR.

SCREEN WRITE WRITR
WRITE RELATIVE

Calling Sequence:	SYSTEM WRITR
	or
	SYSSUK WRITR
	DEFB (X co-ordinate)
	DEFB (Y co-ordinate)
	DEFB (Magic Register)
	DEFW (Pattern address)
Arguments:	HL=Pattern address
	A =Magic Register
	D =Y co-ordinate
	E =X co-ordinate
Output:	DE=Screen Address Used
	A = Magic Register Used

Description:
The relative co-ordinates stored with the pattern are added to the co-ordinates passed in DE. Pattern size is taken from the pattern.

Notes:
If expansion is to be done, the ON/OFF color must be set by the user before calling WRITR.

SCREEN WRITE WRITP

WRITE WITH PATTERN SIZE SCARE UP

Calling Sequence:	SYSTEM WRITP
	or
	SYSSUK WRITP
	DEFB (X co-ordinate)
	DEFB (Y co-ordinate)
	DEFB (Magic Register)
	DEFW (Pattern address)
Arguments:	HL=Pattern Address
	A =Magic Register
	D =Y co-ordinate
	E =X co-ordinate
Output:	DE=Screen Address Used
	A =Magic Register Used

Description:

The pattern size is taken from the pattern.

Notes:

User must worry about ON/OFF color if expansion is used.

SCREEN WRITE WRIT

WRITE PATTERN

Calling Sequence:	SYSTEM WRIT
	or
	SYSSUK WRIT
	DEFB (X co-ordinate)
	DEFB (Y co-ordinate)
	DEFB (X pattern size)
	DEFB (Y pattern size)
	DEFB (Magic Register)
	DEFW (Pattern address)
Arguments:	HL=Pattern Address
	A =Magic Register to use
	B =Y pattern size
	C =X pattern size
	D =Y co-ordinate
	E =X co-ordinate
Output:	DE=Absolute address used
	A =Magic Register used

Notes:

User must set ON/OFF color if using expansion.

SCREEN WRITE WRITA

WRITE ABSOLUTE

Calling Sequence:	SYSTEM WRITA
	or
	SYSSUK WRITA
	DEFW (Absolute address)
	DEFB (X pattern size)
	DEFB (Y pattern size)
	DEFB (Magic Register)
	DEFW (Pattern address)
Arguments:	HL=Pattern Address
	A =Magic Register
	B =Y Pattern size
	C =X Pattern size
	DE=Absolute screen address of upper left-hand corner of where to write

Notes:

This entry can be used for pattern writing to non-magic memory. The value in A is not output to (MAGIC); it is only interrogated to decide whether to FLOP or EXPAND.

SCREEN SAVE

SAVE AREA

Calling Sequence:	SYSTEM SAVE
	or
	SYSSUK SAVE
	DEFW (save area)
	DEFB (X size)
	DEFB (Y size)
	DEFW (Screen address)
Arguments:	B =Y size of area to save
	C =X size of area to save (in bytes)
	DE=Address of save area
	HL=Absolute address of upper left-hand corner of area to save

Description:

SAVE is used to preserve what is 'underneath' a moving pattern. SAVE copies the indicated area of the screen to the save area. The sizes of the area which was saved is preserved in the first two bytes of the save area.

The save area size must be greater than or equal to the X-size times the Y-size plus 2.

The save area may be MAGIC or non-MAGIC.

SCREEN RESTORE

RESTORE AREA

Calling Sequence:	SYSTEM RESTOR
	or
	SYSSUK RESTOR
	DEFW (Save area)
	DEFW (Screen address)
Arguments:	DE=Save area to restore from
	HL=Absolute address of upper left-hand corner of area to restore

Description:

RESTORE is the inverse of SAVE. The size of the area to restore is taken from the first two bytes of the save area.

SCREEN VBLANK
BLANK FROM VECTOR

Calling Sequence:	SYSTEM VBLANK
	or
	SYSSUK VBLANK
	DEFW (Vector address)
	DEFB (X size)
	DEFB (Y size)
Arguments:	D =Y size
	E =X size (in bytes)
	IX=Vector address

Description:
The BLANK bit in the vector status byte is tested. If it is not set, no blanking is done. If it is set, it is reset, then the old screen address is taken from the vector and blanking is done. If FLOPPED is specified by the Magic Register byte in the vector, a flopped blank is done. VBLANK always blanks to zero.

SCREEN BLANK

BLANK AREA

Calling Sequence:	SYSTEM BLANK
	or
	SYSSUK BLANK
	DEFB (X size)
	DEFB (Y size)
	DEFB (Blank to)
	DEFW (Blank address)
Arguments:	HL=Blank address (not MAGIC)
	B =Data to blank to
	D =Y size
	E =X size

Description:

The specified area is blanked to whatever is passed in B.

SCREEN SCROLL
SCROLL WINDOW

Calling Sequence:	SYSTEM SCROLL
	or
	SYSSUK SCROLL
	DEFW (line increment)
	DEFB (# of bytes)
	DEFB (# of lines)
	DEFW (first byte)
Arguments:	B =Number of lines to scroll
	C =Number of bytes on line to scroll
	DE=Line increment
	HL=First byte to scroll

Description:
This routine copies NBYTES from first line +INC to first line. Thus to scroll upward, HL points at the first line (which is over-written) and the line increment would be positive. To scroll downward HL points at the last line and the line increment would be negative. The value in HL is an absolute address calculated by:
BASE OF SCREEN + #BYTES IN X OFFSET +(#lines offset*byte per line)

Note:
This routine can only be used to scroll one line at a time.

SCREEN ALPHANUMERIC

ALPHANUMERIC DISPLAY ROUTINES

HVGSYS provides several routines for the display of alphanumeric information. This section provides information which is common to all of the alphanumeric display routines.

The ASCII character code is used to represent all strings, with the following extensions:

> Characters with hex equivalents in the range 1 - 1F are interpreted as tabulation codes which cause the character display routines to skip over N character positions before writing the following characters.
>
> The characters 2ØH to 63H are displayed as 5 X 7 standard graphics with 3 pixels of horizontal spacing and 1 pixel of vertical spacing.
>
> The characters between 64H and 7FH are interpreted by STRDIS as control codes which cause the contents of registers C, DE, and IX to be changed to the value that follow the string. See table accompanying STRDIS.
>
> The characters between 8ØH and FFH are taken as references to a user supplied alternate character font.

The following argument/register combinations are used by all of the alphanumeric display routines.

Register C contains the options byte formatted as shown below.

ENLARGE FACTOR specifies if the character is to be enlarged in size. The table below defines the possible values for this parameter.

XOR/OR WRITE - all writes are performed through magic memory. Use of one of these options causes the character to be ORed/XORed with what was beneath it.

ON/OFF COLOR - all characters are stored one bit per pixel, but are written two bits per pixel by use of the expander. This field specifies the pixel values to translate the one bit per pixel representation into. For example, the value 11Ø1 specifies that the foreground color is 11, and the background color is Ø1.

OPTION BYTE

ENLARGE FACTOR	XOR WRITE	OR WRITE	ON COLOR	OFF COLOR

ENLARGE FACTOR	HOW MANY TIMES LARGER	ENLARGED SIZE OF SINGLE PIXEL
ØØ	1	1 X 1
Ø1	2	2 X 2
1Ø	4	4 X 4
11	8	8 X 8

D register contains the Y co-ordinate and the E register contains the X co-ordinate. These co-ordinates give the address of the upper left-hand corner where the first character will appear. Upon return, these registers are updated to give the address of the character to the right, (or below if no more space exists on the line). This simplifies the composition of complex messages.

IX register contains the Alternate Font Descriptor. It is required only if alternate font is referenced in call. Each character must be stored in one-bit per pixel format.

The small (3 X 5) character set is displayed using this facility. A word in the system DOPE vector points at a standard alternate font descriptor for this character set.

The format of the alternate font descriptor is shown below.

IX →	Ø	BASE CHARACTER	EQUAL TO FIRST CHARACTER IN TABLE
	1	X FRAME SIZE	CHARACTER SIZE IN BITS + X SPACING
	2	Y FRAME SIZE	CHARACTER SIZE IN BITS + Y SPACING
	3	X PATTERN SIZE	EACH CHARACTER TABLE ENTRY SHOULD BE OF SIZE X PATTERN*Y PATTERN SIZE
	4	Y PATTERN SIZE	
	5 6	CHARACTER TABLE ADDRESS	

SCREEN ALPHANUMERIC DISNUM
DISPLAY BCD NUMBER

Calling Sequence:	SYSTEM DISNUM
	or
	SYSSUK DISNUM
	DEFB (X)
	DEFB (Y)
	DEFB (options)
	DEFB (extended options)
	DEFW (number address)
Arguments:	B =Extended options
	C =Standard alphanumeric options byte
	DE=Standard X,Y co-ordinate
	HL=Address of BCD number
*NOT LOADED	IX=Optional character font descriptor
Outputs:	DE=Updated

Decription:
This routine displays the standard BCD codes Ø through 9. In addition, the codes AH through FH are also defined. The interpretation for these codes are:

A = *	B = +	C = '
D = -	E = .	F = /

If leading zero suppress is set, then instead of displaying a leading zero, a space is displayed. The first non-zero nibble encountered terminates leading zero suppression (including A - F). If the number is zero, a single zero is displayed.

If alternate font is set, the routine will display using codes between AAH and B9H (zero starting at BØH).

SCREEN ALPHANUMERIC DISTIM

DISPLAY TIME

Calling Sequence:	SYSTEM DISTIM
	or
	SYSSUK DISTIM
	DEFB (X co-ordinate)
	DEFB (Y co-ordinate)
	DEFB (options)
Arguments:	DE=X,Y co-ordinates
	X =Options (see note below)
	IX=Alternate Font Descriptor (not loaded)
Outputs:	DE=Updated

Description:

This routine displays the system time (GTMINS,GTSECS) at the co-ordinates specified in the form MM:SS, where M=minutes, S=seconds. Seconds are optional.

Notes:

The small character set is used and one level of enlarge factor is permitted.

Options are the same as the alphanumeric display routine except that bit 7=1 to display colon and seconds; bit 7=Ø to suppress colon and seconds.

SCREEN ALPHANUMERIC CHRDIS
DISPLAY CHARACTER

Calling Sequence:	SYSTEM CHRDIS
	or
	SYSSUK CHRDIS
	DEFB (X co-ordinate)
	DEFB (Y co-ordinate)
	DEFB (options)
	DEFB (Character)
Arguments:	A =ASCII character to display
	C =Standard options byte
	DE=Standard Y,X co-ordinates to begin at
*NOT LOADED	IX=Optional alternate font descriptor address
Outputs:	DE=Updated to next frame

Description:
This is the basic charcter display promative. If tabulation is specified, the co-ordinates are updated but no actual writing occurs.

Notes:
Observe that IX is not loaded by the UPI SUCK facility. If alternate font is used, IX must be loaded with alternate font descriptor address.

Since this routine uses magic memory, it is not re-entrant.

SCREEN ALPHANUMERIC STRDIS
DISPLAY STRING

Calling Sequences:	SYSTEM STRDIS
	or
	SYSSUK STRDIS
	DEFB (X co-ordinate)
	DEFB (Y co-ordinate)
	DEFB (Options)
	DEFW (String)
Arguments:	HL=String address
	C =Standard Options
	DE=Standard Co-ordinates
*NOT LOADED	IX=Alternate Font Descriptor Address
Outputs:	DE=Updated to next frame

Description:
The string pointed at by HL is displayed as optioned. The string is terminated by a zero byte.

Notes:
IX is not loaded by SUCK. STRDIS is not re-entrant.

STRDIS INTERPRETATION OF CODES 64H to 7FH

STRDIS responds to the charcter codes between 64H and 7FH. These codes are taken to specify that certain registers in the context block are to be set to new values. This facility is useful for changing size, write mode, screen co-ordinates, or fonts, during a single STRDIS call.

The following table specifies which registers are loaded for a given code. The order in which the new register data follows the code, is also represented.

64H	C	72H	IX,D
65H	E,C	73H	IX,E,D
66H	D,C	74H	IX,C
67H	E,D,C	75H	IX,E,C
68H	NONE	76H	IX,D,C
69H	E	77H	IX,E,D,C
6AH	D	78H	IX
6BH	E,D	79H	IX,E
6CH	C	7AH	IX,D
6DH	E,C	7BH	IX,E,D
6EH	D,C	7CH	IX,C
6FH	E,D,C	7DH	IX,E,C
7ØH	IX	7EH	IX,D,C
71H	IX,E	7FH	IX,E,D,C

SCREEN VECTORING - VECTORING ROUTINES

Most games involve moving patterns. Most moving patterns move along a line. The home video game operating system provides the vectoring routines to facilitate programming such pattern motion.

The vectoring routines work with a memory array called a vector. Represented within this vector are the co-ordinates of an object, the velocities of the object, and the necessary status information to control the object. By periodically invoking the vectoring routine, this data is updated and can be used to direct the motion of a pattern.

More formally, a vectored object possesses an X and Y co-ordinate. Associated with these co-ordinates are velocities ΔX and ΔY, which are added to X and Y every time increment. Since the screen is finite, there also exists two upper and two lower limits X_{LU}, X_{LL}, Y_{LU}, and Y_{LL}, the attainment of which requires some response. The HVGSYS vectoring routine allows for two different responses to a limit attained. Either the sign of the delta is reversed or vectoring is stopped for this co-ordinate. This is specified by a flag byte. When attainment occurs, this fact is indicated by a status byte. Also the co-ordinate is set equal to the limit that was attained, preventing over-shoot.

Utilization of the vectoring routines involves a number of user responsibilities. The user must properly initialize certain fields in the vector array. He must increment the time base byte, and periodically call the vectoring routine. Status bits must be checked and writing must be done.

To insure high-accuracy, co-ordinates and deltas are double-precision. The assumed binary "decimal point" is between the high and low order byte.

The following diagrams explain the layout of the vector array and the attendant user responsibilities.

VECTOR BLOCK

BYTE	FUNCTION	HVGLIB NAME	
0	MAGIC REGISTER	VBMR	– DO NOT USE BIT 7
1	VECTOR STATUS	VBSTAT	
2	TIME BASE	VBTIMB	– INCREMENTED BY USER
3	ΔX	VBDXL	
4		VBDXH	
5	X	VBXL	
6		VBXH	
7	X CHECKS MASK	VBXCHK	
8	ΔY	VBDYL	
9		VBDYH	
10	Y	VBYL	
11		VBYH	
12	Y CHECKS MASK	VBYCHK	
13	OLD SCREEN ADDRESS	VBOAL	– MAINTAINED BY USER
14		VBOAH	

VECTOR STATUS DETAIL

ACTIVE VBSACT	BLANK VBBLNK	NOT USED

ACTIVE	Set by user to indicate that vector is active. The vectoring routines will do no processing if reset.
BLANK	Must be initialized by user to reset state. Thereafter this bit is maintained by the VWRIT and VBLANK system routines.

CHECKS MASK DETAIL

NOT USED	LIMIT ATTAINED VBCLAT	NOT USED	REVERSE DELTA SIGN VBCREV	LIMIT CHECK VBCLMT

LIMIT CHECK	Set by user to indicate that this co-ordinate is to be limit checked.
REVERSE DELTA	Set by user to indicate that when this co-ordinate attains it's limit, the sign of the associated delta is to be reversed. This can be used to cause objects to 'bounce' off barriers.
LIMIT ATTAINED	Set by system if the limit was attained this call. Otherwise it is reset. If the delta was not changed, either by Reverse Delta or user, this bit will stay set.

SCREEN VECTORING VECT

VECTOR OBJECT IN TWO DIMENSIONS

Calling Sequence:	SYSTEM VECT
	or
	SYSSUK VECT
	DEFW (Vector address)
	DEFW (Limit table)
Arguments:	HL=Limit table address
	IX=Vector address (points at VBMR)
Output:	C =Time base used
	Z =True, if it did not move

Description:

If the vector is inactive, control is returned immediately. Otherwise VECTC is called for X, then Y. The zero status is determined by comparing the new co-ordinate value with it's old value. If the high-order byte changed, then the object moved. Zero status set if object did not move, reset if object moved.

SCREEN VECTORING VECTC
VECTOR A CO-ORDINATE

Calling Sequence:	SYSTEM VECTC
	or
	SYSSUK VECTC
	DEFW (co-ordinate address)
	DEFW (Limit table)
Arguments:	IX=Pointer to low-order byte of delta for co-ordinate
	HL=Limits table for this co-ordinate (if required)
	C =Time base to use

Description:
This routine operates on the subset of the vector array associated with a single co-ordinate. This subset consists of the delta co-ordinate and checks mask. This entry is provided so special vectoring schemes may be implemented such as 1 dimensional or 3 dimensional vectoring.

This entry adds the delta to the co-ordinate time base times. It then performs the limit checks for the co-ordinate if optioned.

Note that this entry does not interrogate or alter any bytes in the vector array outside of the defined subset. Hence the active bit isn't checked.

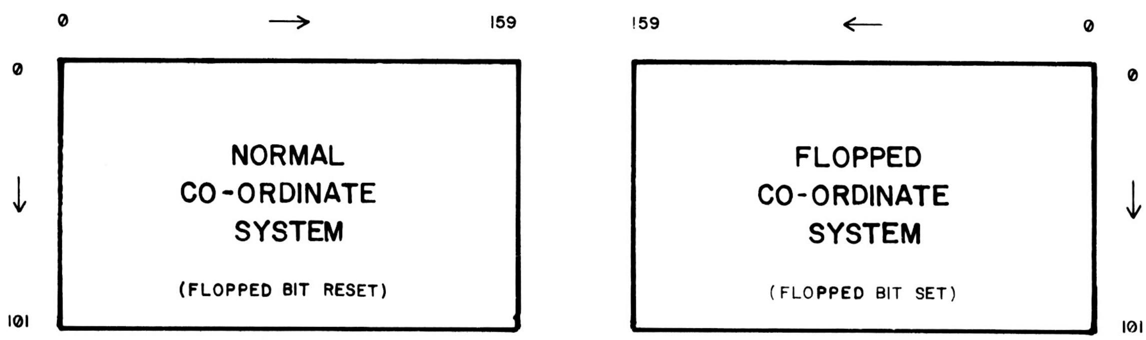
SCREEN RELABS

CONVERT RELATIVE CO-ORDINATES TO ABSOLUTE MAGIC ADDRESS AND SET UP MAGIC REGISTER

Calling Sequence:	SYSTEM RELABS
	or
	SYSSUK RELABS
	DEFB (Magic register value)
Arguments:	A =Magic register value to set
	D =Y co-ordinate
	E =X co-ordinate
Output:	A =Magic register value, with proper shift amount set
	DE=Absolute memory address (MAGIC)

Description:

The low-order two bits of the X co-ordinate are inserted into the magic register value bitstring. The absolute memory address corresponding to the co-ordinate is computed, taking into consideration the value of the flopped bit. The co-ordinate systems used are shown below.



SCREEN RELAB1

CONVERT RELATIVE ADDRESS TO ABSOLUTE NORMAL ADDRESS

Calling Sequence:	SYSTEM RELAB1
	or
	SYSSUK RELAB1
	DEFB (Magic register value)
Arguments:	A =Magic register value to combine with shift amount
	D =Y co-ordinate
	E =X co-ordinate
Output:	A =Combined magic register value
	DE=Absolute normal address (not magic)

Description:

This routine is identical to RELABS except that a non-magic address is returned and the hardware magic register is not set. The flopped bit is interrogated and the flopped co-ordinate system is used, if optioned.

SCREEN COLSET

SET COLOR REGISTERS

Calling Sequence:	SYSTEM	COLSET
	or	
	SYSSUK	COLSET
	DEFW	(Address of color list)
Inputs:	HL=Color list laid out	
	COL3L=first to	
	COLOR last ie: COLOR would be at a higher address than COL3L	

Description:

This routine sets color registers and saves address of colors for use by PIZBRK and BLAKOUT for color restoration.

HUMAN INCSCR

INCREMENT SCORE AND COMPARE TO END SCORE

Calling Sequence:	SYSTEM INCSCR
	or
	SYSSUK INCSCR
	DEFW (address of score)
Arguments:	HL=Address of score (must be 3 bytes long)
Output:	Score incremented and optionally game over bit set

Description:

The 3 byte score pointed at by HL (BCD with low-order byte at lowest address) is incremented (by 1) and compared to the end score (ENDSCR). If the end score bit (GSBSCR) was set in the game status byte (GAMSTB) and end score has been reached, then the game over bit (GSBEND) is set in the game status byte.

HUMAN PAWS

PAUSE

Calling Sequence:	SYSTEM PAWS
	or
	SYSSUK PAWS
	DEFB (number of interrupts)
Arguments:	B=Number of interrupts to wait

Description:

This routine provides for a pause for certain number of interrupts. If used with ACT INT, 6Ø will be a 1-second pause. This routine does an EI upon entry and assumes interrupts will occur.

HUMAN KEYBOARD KCTASC

KEY CODE TO ASCII

Calling Sequence:	SYSTEM KCTASC
Arguments:	B=Key code (not loaded)
Output:	A=ASCII equivalent of keycode
Description:	This routine does a table look-up

KEYCODE	NAME	GRAPHIC	HEX VALUE
1	Clear	C	43
2	Up Arrow	↑	5E
3	Down Arrow	↓	5C
4	Percent	%	25
5	Recall	MR	52
6	Store	MS	53
7	Change sign	CH	3B
8	Divide	÷	2F
9	7	7	37
10	8	8	38
11	9	9	39
12	Times	X	2A
13	4	4	34
14	5	5	35
15	6	6	36
16	Minus	-	2D
17	1	1	31
18	2	2	32
19	3	3	33
20	Plus	+	2B
21	Clear Entry	CE	26
22	Ø	Ø	3Ø
23	Decimal point	.	2E
24	Equals	=	3D

HUMAN CONTROLS & KEYPAD   SENTRY
SENSE TRANSITION

Calling Sequence:	SYSTEM SENTRY
	or
	SYSSUK SENTRY
	DEFW (Key mask address)
Arguments:	DE=Keypad mask table

Description:
SENTRY checks for changes in the potentiometers (pots), control handles, triggers, keypad, semiphores and counter/timers. It also takes care of blackout. Blackout is the automatic blacking-out of the screen after 255 seconds without a change. If SENTRY isn't called then the game will not black out.

SENTRY checks if TIMOUT equals Ø on entry and if zero, it goes to PIZBRK. If a key has gone down or a control handle changed, then TIMOUT is set to FFH.

HL should point at a keypad mask. The keypad consists of 6 rows by 4 columns.

Example mask of	DEFB	Ø111ØØB
just Ø - 9	DEFB	1111ØØB
	DEFB	Ø111ØØB
	DEFB	ØØØØØØB

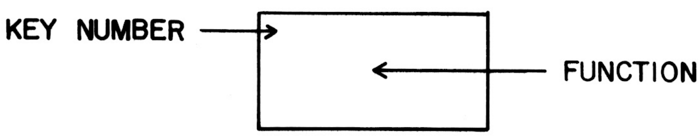
See diagram on following page.

Mask byte 1	Mask byte 2	Mask byte 3	Mask byte 4	Mask bit number
1 C	2 ↑	3 ↓	4 %	0
5 MR	6 MS	7 CH	8 ÷	1
9 7	10 8	11 9	12 X	2
13 4	14 5	15 6	16 −	3
17 1	18 2	19 3	20 +	4
21 CE	22 0	23 .	24 =	5

MASK BIT NUMBER

1 2 3 4

MASK BYTE NUMBER



Output: A=Return code
B=Extended code

PRIORITY	A=	MEANING
	SNUL	Nothing changed
1	SCTØ	Counter/timer Ø decremented to Ø
	to	
1	SCT7	Counter/timer 7 decremented to Ø
2	SFØ	SEMI4S bit Ø was 1
	to	
2	SF7	SEMI4S bit 7 was 1
4	SSEC	1 second has elapsed since the last SSEC
5	SKYU	Keypad went from down to up B=Ø
5	SKYD	Key is down B=key number
3	SPØ	Pot Ø changed B=new value
	to	
3	SP3	Pot 3 changed B=new value
6	SJØ	Joystick Ø changed B=new value
	to	
6	SJ3	Joystick 3 changed B=new value
6	STØ	Trigger Ø changed B=new value
	to	
6	ST3	Trigger 3 changed B=new value

Notes:
The potentiometers (pots) are debounced. New trigger value=Trigger off (Ø) or trigger on (1ØH). When switches are actuated simultaneously the order of return is: SCT7 to SCTØ, SF7 to SFØ, SPØ to SP3, SSEC, SKYU, SKYD, SJØ, STØ, SJ1, ST1, SJ2, ST2, SJ3, ST3.

HUMAN CONTROL DOIT
RESPOND TO INPUT TRANSITION

Calling Sequence:	SYSTEM DOIT
	or
	SYSSUK DOIT
	DEFW (Do table)
Arguments:	A =SENTRY return code
	B =Extended return code
	HL=Do table address

Description:
The SENTRY return code is used to search the DOTABLE. If the transition is present in DOTABLE, then control is transferred to the associated handling routine. The handling routine may be MACRO or machine instructions. The routine receives registers as they are on DOIT entry. If no transition is found, execution continues at the first instruction following call. The DOTABLE is a linear list composed of 3 bytes entries, 1 entry per SENTRY return code.

TRANSFER TYPE	RETURN CODE
HANDLER ADDRESS	

Where transfer type designates how handler address is to be transferred to. The codes are: ØØ=JMP to machine language routine and pop context; Ø1=RCALL machine language routine in current context; 1Ø=MCALL interpreter routine in current context. Mode Ø1 and 1Ø expect the returned-to point to be interpretive, mode Ø expects it to be machine instructions.
End of list is indicated by a terminator byte which is greater than or equal to CØH.

HUMAN CONTROL PIZBRK

"COFFEE BREAK" BLACK OUT SCREEN AND WAIT FOR KEY

Calling Sequence:	SYSTEM PIZBRK
	or
	SYSSUK PIZBRK
Input:	NONE
Output:	NONE

Description:

This routine blacks out the screen and waits for either a key press or a trigger or a joystick change.

This function should be called whenever a "hold until further notice" is needed.

All keys on the keypad are enabled. Interrupts are disabled on entry and enabled on exit. It is a good idea to reset any 60th of a second timers on exiting PIZBRK.

HUMAN CONTROLS   EXAMPLE

This routine echoes number keys and takes a coffee break on trigger Ø being pulled. Assumes SP is set and screen erases.

```
        SYSTEM  INTPC
LOOP:   DO      SENTRY
        DEFW    NUMBAS
        DO      DOIT
        DEFW    DTAB
        DO      MJUMP
        DEFW    LOOP

NUMBAS: DEFB    Ø111ØØB           ;NUMBER KEYS ONLY
        DEFB    1111ØØB
        DEFB    Ø111ØØB
        DEFB    Ø

DTAB:   MC      SKYD,SHOW         ;ON KEY DOWN MACRO CALL
        MC      STØ,PBREAK+END    ;ON TO MACRO CALL

SHOW:   DO      KCTASC            ;CONVERT TO ASCII
        DO      SUCK
        DEFB    ØØØØØ111B         ;X,Y=Ø=DE
        DEFB    11ØØ11ØØB         ;OPTIONS=C
        DONT    CHRDIS            ;DISPLAY CHAR
        MRET                      ;BACK TO LOOP

PBREAK: DO      PIZBRK            ;COFFEE BREAK
        DO      MRET              ;BACK TO LOOP
```

INTERRUPT MUSIC PROCESSOR

The music processor can be thought of as an independent CPU handling all output to the music/noise ports. The MUZCPU has 4 registers:

MPC:	Like all program counters, points to the next data byte to fetch.
MSP:	Like a stack pointer, points to return addresses on the stack.
DURATION:	Is loaded at the start of a note and then decremented every 60th of a second
VOICES:	Is a status register. It tells which voices (tones) to load with what data.

The voices status register is shown below. Execution proceeds right-to-left. Make sure that you always have at least one PC incrementing bit or load on.

INC PC	OUT TONE A	INC PC	OUT TONE B	INC PC	OUT TONE C	OUT VIBRA	OUT VOLN

MUZCPU INSTRUCTION SET

# OF BYTES	MNEMONIC	COMMENT
2	VOICES,(data)	;VOICES=(data)
2	MASTER,(data)	;TONEØ=(data)
3	CALL,(address)	;(SP)=(PC+3) PC=address
1	RET	;PC=(SP++)
3	JP,(address)	;PC=address
2	NOTE1	;Duration, note or data (D1)
3	NOTE2	;Duration, D1,D2
4	NOTE3	;Duration, D1,D2,D3
5	NOTE4	;Duration, D1,D2,D3,D4
6	NOTE5	;Duration, D1,D2,D3,D4,D5
2	REST	;Duration in 6Øths of a second
		;Pauses silently (except legato)
1	QUIET	;Stops music and sets volume=Ø
2	OUTPUT	;Port #, Data
9	OUTPUT	;SNDBX,DATA1Ø,D11,D12,D13,D14,D15,D16,D17
3	VOLUME	;(VOLAB),(VOLMC) sets volume for notes
1	PUSHN	;Push # between 1-16 onto the stack
1	CREL	;Call relative to next instruction
3	DSJNZ	;decrement stack top and jump
		;if not Ø, else pop stack
1	LEGSTA	;flips between STACATO and LEGATO modes
		;STACATO is clipped 1/60th before the
		;end of each note
		;LEGATO allows one note to run into
		;the next

Note: All durations are limited to a maximum of 127

MUSIC SCORE EXAMPLE

```
VOICES   11Ø1Ø1ØØB        ;ABC=Data 1
MASTER   ØA1H             ;ABC=½
VOLUME   88H,Ø8H
NOTE1    12,A1
NOTE1    12,C2
NOTE1    24,E2
NOTE1    12,C2
NOTE1    12,E2
REST     6
VOICES   1111Ø11ØB        ;Suck in Vibrato, AB and C bytes
NOTE3    12,14,A2,E2
QUIET
```

INTERRUPTS MUSIC BMUSIC

BEGIN PLAYING MUSIC

Calling Sequence:	SYSTEM BMUSIC
	or
	SYSSUK BMUSIC
	DEFW (Music stack)
	DEFB (voices byte)
	DEFW (Score)
Arguments:	A =Voices to start with
	HL=Music PC (Score)
	IX=Music SP

Description:

Quiets any previous music, then interprets "score". See music processor for more information.

INTERRUPTS   MUSIC   EMUSIC

STOP MUSIC

Calling Sequence:	SYSTEM EMUSIC
	or
	SYSSUK EMUSIC
Arguments:	NONE
Outputs:	NONE

Description:

Outputs Ø to volume ports and halts music processor.

INTERRUPTS ACTINT

ACTIVE INTERRUPTS

Calling Sequence:	SYSTEM ACTINT or SYSSUK ACTINT
Input:	NONE
Output:	NONE
Function:	Sets IM=2, INLIN=2ØØ, sets I reg + INFBK Calls TIMEX and TIMEY Enables interrupts

Description:

Once ACTINT is called, it provides interrupt service completely automatically. It runs the seconds timer, the game timer, the music processor, and black-out timers, plus CTØ, CT1, CT2, CT3. Functions as 6Øth of a second timers.

INTERRUPTS TIMERS DECCTS

DECREMENT COUNTER/TIMERS

Calling Sequence:	SYSTEM DECCTS
	or
	SYSSUK DECCTS
	DEFB (Mask)
Input:	C=Mask indicative which counters to decrement.
Output:	Sentry will notify the program.

Description:

Decrements counter if they are non-zero. If any go from 1 to Ø, sentry is notified.

INTERRUPTS   TIMERS   CTIMER

Calling Dequence:	CALL CTIMER
Input:	HL=Address of custom time base
	B =Value to load into time base 1 to Ø transition
	C =CT mask as in DECCTS

Description:

HL is loaded and decremented. If it is not = Ø, then a return is executed. Else, HL is loaded with B and DECCTS is called.

Registers HL, DE, BC, and AF are undefined upon exit.

INTERRUPTS TIMERS STIMER

DECREMENT TIMERS

Calling Sequence:	PUSH	AF
	PUSH	BC
	PUSH	DE
	PUSH	HL
	CALL	STIMER
	POP	HL
	POP	DE
	POP	BC
	POP	AF
Input:	NONE	
Description:	STIMER keeps track of game time. If it hits Ø, then the GSBEND bit in the game status byte is set.	
Uses:	AF, BC, DE, HL	
Calls:	Music processor on note (duration) expiration.	
Note:	Sets bit 7 of key sex to 1 on every second.	

MOVE MOVE BYTES

Calling Sequence:	SYSTEM MOVE
	or
	SYSSUK MOVE
	DEFW (Destination)
	DEFW (Number of bytes)
	DEFW (Source)
Arguments:	DE=Destination address
	HL=Source address
	BC=Number of bytes to transfer
Description:	MOVE uses LDIR to copy bytes from source to destination.

INDEXN   INDEX NIBBLE

Calling Dequence: SYSTEM   INDEXN
or
SYSSUK   INDEXN
DEFW   (Base Address)

Arguemnts: C =Nibble displacement (Ø - 255)
HL=Base address of table

Output: A =Nibble value

Description:
INDEXN is used to look up a given nibble in a linear list.
The indexing works like:

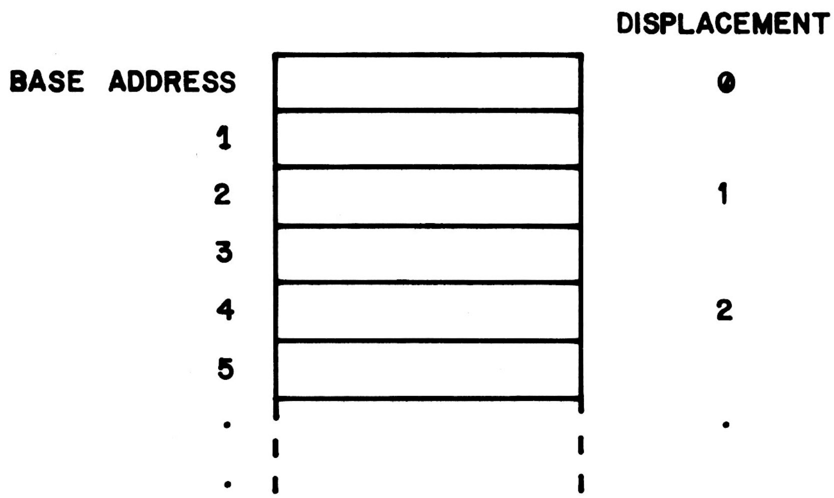
BASE ADDRESS	1	0
1	3	2
2	5	4
3	7	6
.		
.		

STOREN   STORE NIBBLE

Calling Dequence:	SYSTEM STOREN	
	or	
	SYSSUK STOREN	
	DEFW (Base address)	
Arguments:	C =Nibble displacement	*NOT LOADED
	HL=Base address	
	A =Nibble value to store	*NOT LOADED
Description:	STOREN is the inverse of INDEXN. STOREN works as with INDEXN.	

INDEXW INDEX WORD

Calling Sequence:	SYSTEM INDEXW
	or
	SYSSUK INDEXW
	DEFW (Base address)
Arguments:	A =Displacement (Ø - 255) *NOT LOADED
	HL=Base address of table
Output:	DE=Entry looked up
	HL=Address of entry looked up
Description:	Indexing looks like:



INDEXB INDEX BYTE

Calling Sequence:	SYSTEM INDEXB
	or
	SYSSUK INDEXB
	DEFW (Base address)
Arguments:	A =Displacement (Ø - 255)
	HL=Base address of table
Output:	A =Entry looked up
	HL=Address of entry looked up

Notes:

INDEXB returns the byte at address

(Base address) + (Displacement)

SETB STORE BYTE

Calling Sequence:	SYSTEM SETB
	or
	SYSSUK SETB
	DEFB (Value to store)
	DEFW (Address)
Arguments:	A =Byte value to store
	HL=Address to be set
Description:	Stores an 8-bit value at a specified address.

SETW STORE WORD

Calling Sequence:	SYSTEM SETW
	or
	SYSSUK SETW
	DEFW (Value to store)
	DEFW (Address)
Arguments:	DE=Word value to store
	HL=Address to be set
Description:	Stores a 16-bit value at a specified address.

CASSETTE CONVENTIONS

Two types of cassettes may be used with the Bally Professional Arcade. The first type, called an autostart cassette, is entered immediately after reset. The only initialization that is performed before entry is the set-up of the stack pointer to point just below system RAM and the establishment of "consumer mode" in the custom chips. RAM is not altered in this mode.

The second type, called a standard cassette, is entered after a game selection process is completed. Considerably more initialization is done by the system before control transfer.

1) System RAM is cleared to Ø
2) The ACTINT interrupt routine is enabled
3) The MENU colors are set in the left color map
4) Vertical blank is set at line 96, horizontal boundary at 41, and interrupt mode at 8.
5) The screen displays the menu frame.
6) The shifter is cleared.

An autostart cassette is indicated by a jump instruction (opcode C3H) at location 2ØØØH. This jump instruction should branch to the starting address of the cassette.

A standard cassette is indicated by a sentinel byte of 55H at location 2ØØØH. Following this byte is the first node of the cassette's menu data structure. This data structure gives the name and starting address of each program in the cassette. (See MENU)

When the user has selected a cassette game, control is transferred to the starting address with the address of the program name string in the registers. The cassette program will use the GETPAR system routine to prompt for game parameters such as score to play to, game time limit or number of layers.

The cassette has access to the six unused restart instructions. See the following cassette diagram for the transfer vectors.

BYTE		
2000	0 | 1 | 0 | 1 | 0 | 1 | 0 | 1	SENTINEL
1 2	NEXT MENU NODE	MENU NODE FOR FIRST GAME ON CASSETTE
3 4	STRING ADDRESS FOR FIRST GAME	
5 6	START ADDRESS FOR FIRST GAME	
7 8 9	RST 8 JUMP VECTOR	THESE CELLS MAY BE USED FOR PROGRAM IF THE ASSOCIATED RST OR HOOK IS NOT USED
A B C	RST 16	
D E F	RST 24	
2010 1 2	RST 32	
3 4 5	RST 40	
6 7 8	RST 48	
9 A B	SENTRY HOOK TRANSFER VECTOR USED FOR DEMO PROGRAMS	

HUMAN GETPAR

GET GAME PARAMETER

Calling Sequence:	SYSTEM GETPAR	
	or	
	SYSSUK GETPAR	
	DEFW (Prompt)	
	DEFB (Digits)	
	DEFW (Parameter)	
Arguments:	A =Number of digits to get	
	BC=Address of prompt string	
	DE=Title string address	*NOT LOADED
	HL=Address of parameter to get	

Description:

A menu frame is created displaying the title passed in DE at the top. The message "ENTER" is displayed in the center of the screen followed by the prompt string. GETNUM is entered with feedback specified in 2X enlarged characters. After entry is complete, GETPAR pauses for ¼ second to allow user to see his entry and then returns.

Notes:

See entry conditions and resource requirements for menu.

Prompt string example: "# OF PLAYERS"

The title string address (DE) is usually the title returned from MENU.

The address of parameter to get (HL), HL points at the low-order byte of BCD number in RAM.

HUMAN MENU

DISPLAY MENU AND BRANCH ON SELECTION

Calling Sequence:	SYSTEM MENU
	or
	SYSSUK MENU
	DEFW (Title)
	DEFW (List)
Arguments:	DE=Address of menu title string
	HL=Address of menu list
Output:	DE=String address of selection mode

Description:

The title is displayed at the top of the screen. Each entry in the menu list is then displayed with a preceding number supplied by MENU. GETNUM is called to get the selection number. The menu list is searched for the selected node and it is jumped to.

Notes:

A maximum of eight entries may appear.

On entry, MENU expects interrupts to be enabled, colors and boundaries to be set up. MENU uses 96 lines of screen, creams the alternate set, and requires three levels of context. MENU calls SENTRY and thus 'eats' all irrelevant transitions.

NEXT	ADDRESS OF NEXT NODE ON LIST ZERO IF THIS NODE IS LAST
STRING	ADDRESS OF NAME OF THIS SELECTION THIS IS WHAT IS PASSED IN DE
GO TO	WHERE TO BRANCH TO IF THIS SELECTION IS SELECTED

HUMAN GETNUM

GET NUMBER

Calling Sequence:	SYSTEM GETNUM
	or
	SYSSUK GETNUM
	DEFB (X address)
	DEFB (Y address)
	DEFB (CHRDIS options)
	DEFB (DISNUM options)
	DEFW (Number address)
Arguments:	B =Display number routine options
	C =Character display routine options
	DE=Y,X co-ordinate for feedback
	HL=Address of where to put entered number

Description:

This routine inputs a number from either the keypad or the pot on control handle of player one. Keypad entry has priority. The routine exits when the specified number of digits were entered or = is pressed on the keypad.

Pot entry is enabled by pressing the trigger. The current pot value is then shown. Twist the pot until the number you want is shown. Then press the trigger again to complete entry. The pot can only enter 1 or 2 digits. If a group of numbers is being entered, the user must enable entry for each new number.

DISPLAY NUMBER OPTIONS

ZERO SUPP	ALT FONT	NUMBER OF DIGITS TO DISPLAY/ACCEPT

CHARACTER DISPLAY OPTIONS

ENLARGE FACTOR	XOR	OR	ON COLOR	OFF COLOR

HUMAN MSKTD

JOYSTICK MASK TO DELTAS

Calling Sequence:	SYSTEM MSKTD	
	or	
	SYSSUK MSKTD	
	DEFW (X Delta)	
	DEFB (Flop-flag)	
	DEFW (Y Delta)	
Arguments:	B =Joystick mask	*NOT LOADED
	C =Flop flag	
	DE=X positive delta	
	HL=Y positive delta	
Output:	DE=X Delta	
	HL=Y Delta	

Description:

This routine uses the joystick mask and flop flag to conditionally modify the passed deltas. If negative direction is indicated, the delta is 2's complemented; if no direction is indicated, Ø is returned.

Note: B is not sucked.

MATH RANGED

RANGED RANDOM NUMBER

Calling Sequence:	SYSTEM RANGED or SYSSUK RANGED DEFB (N)
Arguments:	A=N where ∅ is less than or equal to a random numner less than N (ie: for a random number of ∅,1,or 2, N=3)
Output:	A=Random Number

Notes;

If N is a power of 2, it is considerably faster to use N=∅ which causes an 8-bit value to be returned without ranging. Use an AND instruction to range it yourself.

This routine uses a polynomial shift register RANSHT in system RAM. RANGED is called in GETNUM while waiting for game selection/parameter entry. Thus each execution of a program will receive different random numbers. For 'predictable' random numbers, alter RANSHT yourself after parameter acceptance.

INTRODUCTION

The Bally Professional Arcade is a full-color video game system based on the mass-ram-buffer technique. A mass-ram-buffer system is one in which one or more bits of RAM are used to define the color and intensity of a pixel on the screen. The picture on the screen is defined by the contents of RAM and can easily be changed by modifying RAM.

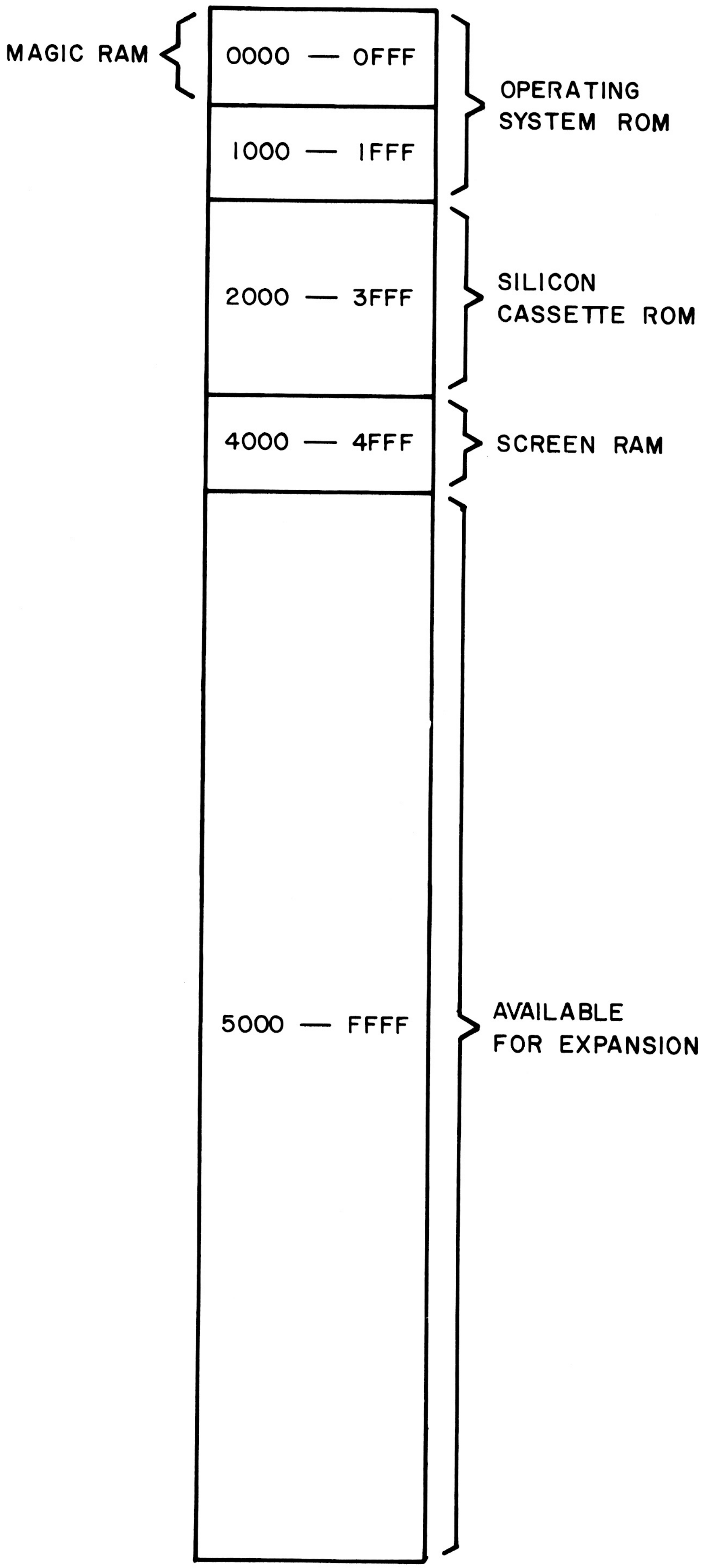
The system uses a Z-80 Microprocessor as it's main control unit. The system ROM has software for four games: Gunfight, Checkmate, Scribbling, and Calculator. Additional ROM can be accessed through the silicon cassette connector. Three custom chips are used for the video interface, special video processing functions, keyboard and control handle interface, and audio generation.

The system exists in both high-resolution and low-resolution models. The three custom chips can operate in either mode. The mode of operation is determined by bit Ø of output port 8H. It must be set to Ø for low-resolution and 1 for high-resolution. This bit is not set to Ø at power up and must be set by software before any RAM operations can be performed.

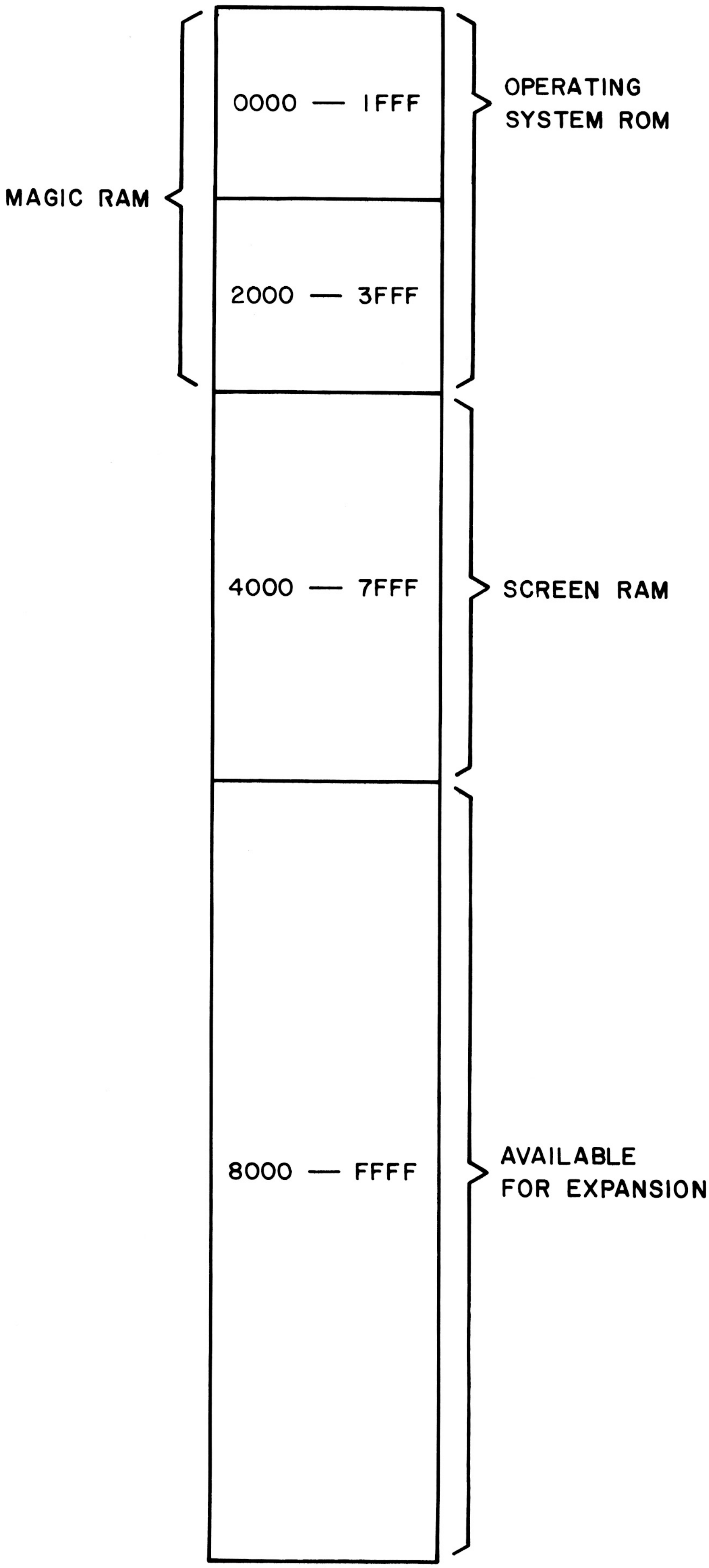
MEMORY MAP

In both the low and high resolution models, the operating system ROM is in the first 8K of memory space. The silicon cassette ROM is in the space from 8K to 16K. The standard screen RAM begins at 16K. In the low-resolution unit, standard screen RAM is 4K bytes; in the high-resolution unit it is 16K bytes. Magic screen RAM begins at location Ø. It is the same size as standard screen RAM. All memory above 32K is available for expansion. In the low-resolution unit, memory space 20K - 32K is available for expansion.

When data is read from a memory location between Ø and 16K the data comes from the ROM. When data is written in a memory location (X) between Ø and 16K, the system actually writes a modified from of the data in location X+16K. The modification is performed by the magic system in the Data Chip and Address Chip. Thus the RAM from 0 to 16K is called Magic Memory.



MEMORY MAP LOW RESOLUTION



MEMORY MAP HIGH RESOLUTION

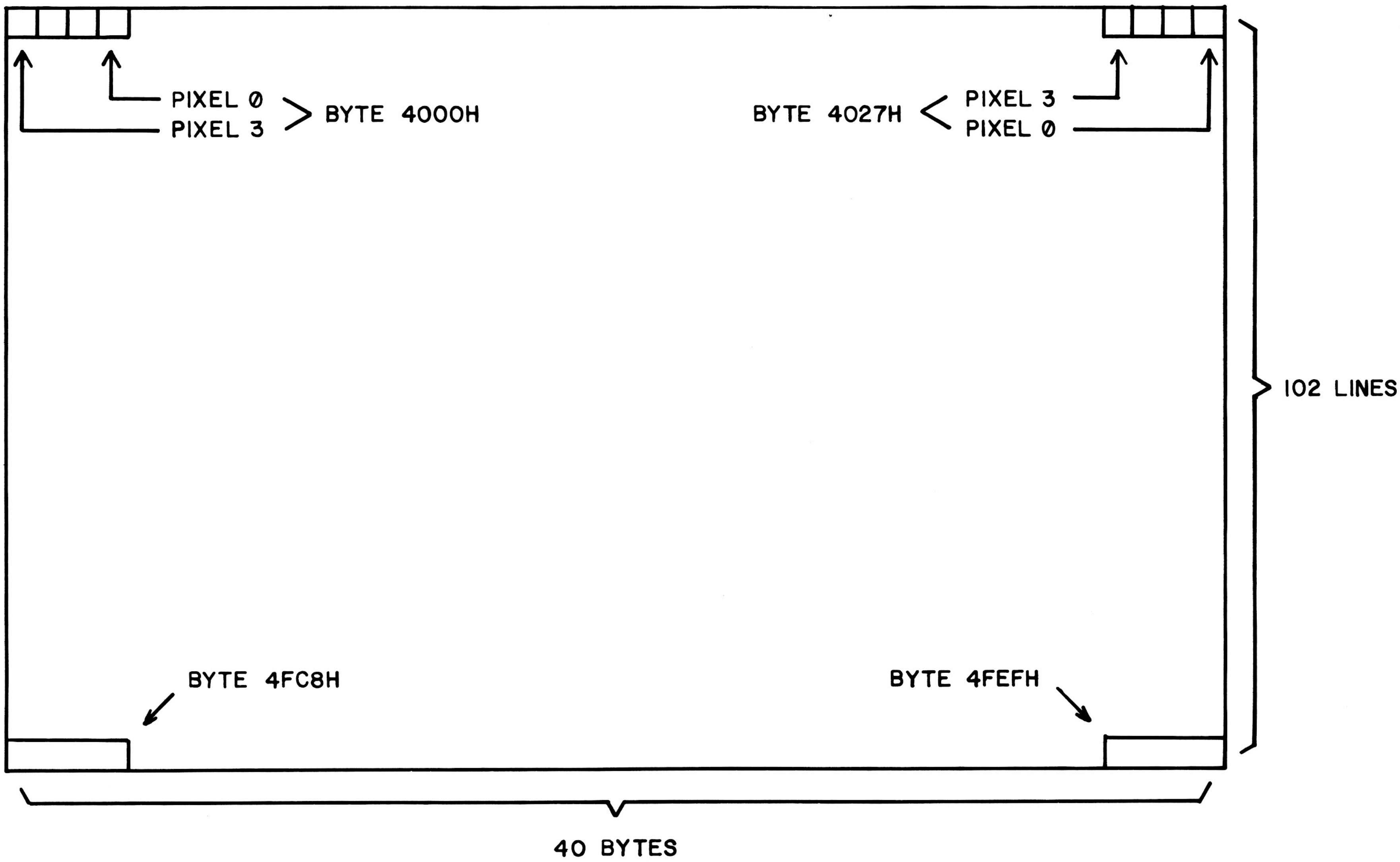
SCREEN MAP

In the Bally Professional Arcade, two bits of RAM are used to define a pixel on the screen. One 8-bit byte of RAM therefor defines four pixels on the screen.

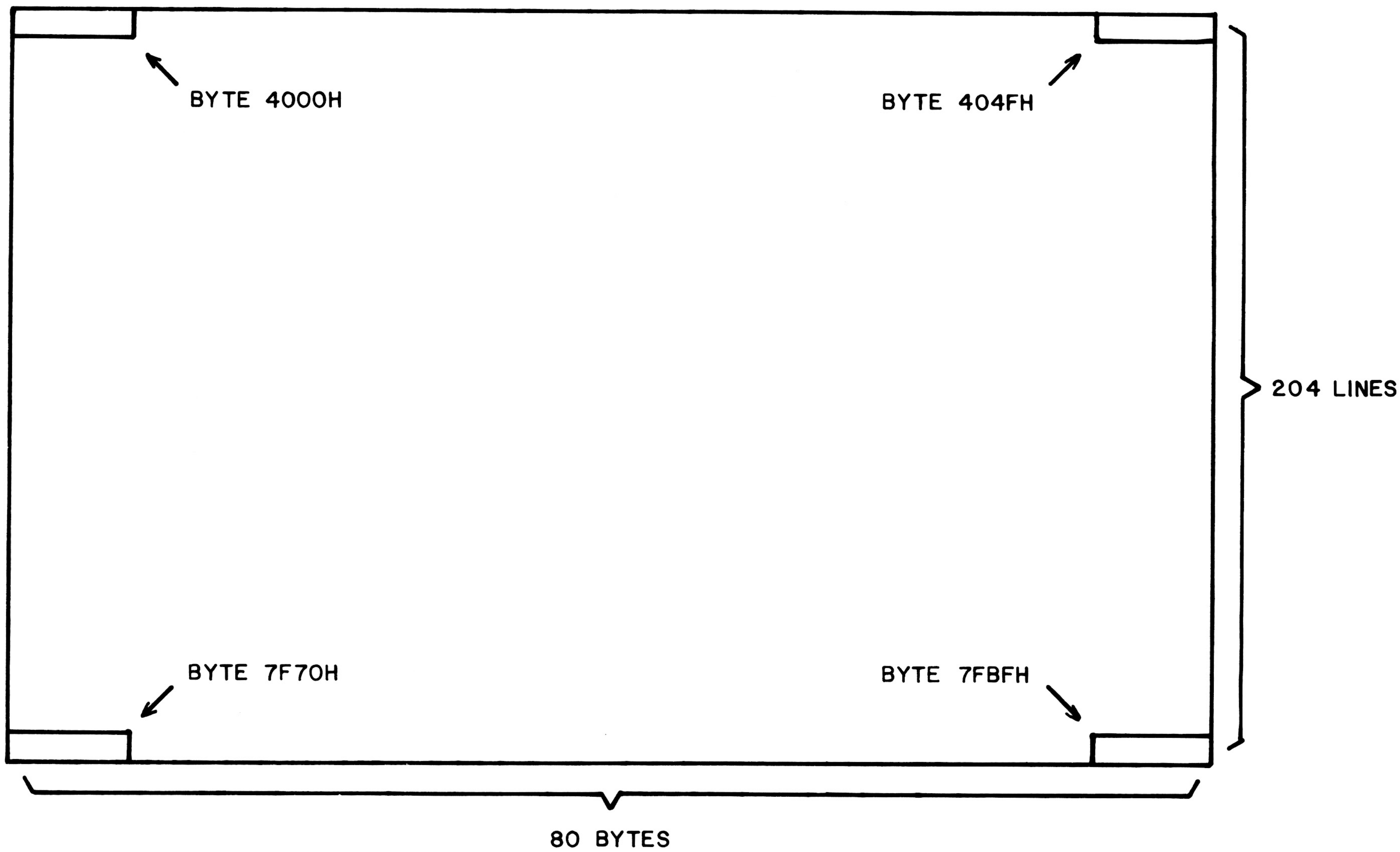
In the low-resolution model there are 40 bytes used to define a line of data. This gives a horizontal resolution of 160 pixels. The vertical resolution is 102 lines. The screen therefor requires 102 X 40 = 4,080 bytes. The remaining 16 bytes of the 4K RAM are used for scratch pad. More of the RAM can be used for scratchpad by blanking the screen before the 102nd line. This will be described later.

In the high-resolution model there are 80 bytes and 320 pixels per line. The 204 lines require 16,320 bytes of RAM. 64 bytes of the 16K RAM are left for scratch pad.

In both models the first byte of RAM is in the upper left-hand corner of the screen. As the RAM address increases, the position on the screen moves in the same directions as the TV scan; from left-to-right and from top-to-bottom. The four pixels in each byte are displayed with the least significant pixel, the one defined by bits Ø and 1, on the right.



SCREEN MAP LOW RESOLUTION



SCREEN MAP HIGH RESOLUTION

COLOR MAPPING

Two bits are used to represent each pixel on the screen. These two bits, along with the LEFT/RIGHT bit which is set by crossing the horizontal color boundary, map each pixel to one of eight different color registers. The value in the color register then defines the color and intensity of the pixel on the screen. The intensity of the pixel is defined by the three least significant bits of the register, ØØØ for darkest and 111 for lightest. The color is defined by the five most significant bits. The color registers are at output ports Ø through 7; register Ø at port Ø, register 1 at port 1, etc.

The color registers can be accessed as individual ports ar all eight can be accessed by one OTIR instruction. The OTIR instruction is to port BH (register C=BH) and register B should be set to 8. The eight bytes of data pointed to by HL will go to the color registers

```
HL --> Memory Location X   Color Register 7
                       X+1 Color Register 6
                       X+2 Color Register 5
                       X+3 Color Register 4
                       X+4 Color Register 3
                       X+5 Color Register 2
                       X+6 Color Register 1
                       X+7 Color Register Ø
```

The horizontal color boundary (bits Ø-5 of port 9) defines the horizontal position of an imaginary vertical line on the screen. The boundary line can be position between any two adjacent bytes in the low-resolution system. The line is immediately to the left of the byte whose number is sent to bits Ø-5 of port 9. For example, if the horizontal color boundary is set to Ø, the line will be just to the left of byte Ø; if it is set to 20, the line will be between bytes 19 and 20 in the center of the screen.

If a pixel is to the left of the boundary, its LEFT/RIGHT bit is set to 1. The LEFT/RIGHT bit is set to Ø for pixels to the right of the boundary. Color registers Ø-3 are used for pixels to the right of the boundary and registers 4-7 are used for pixels to the left of the boundary.

In the high-resolution system, the boundary is placed in the same position on the screen but between different bytes. If the value X is sent to the horizontal color boundary, then the boundary will be between bytes 2X and 2X-1. If the value 20 is sent, the boundary will be between 39 and 40, in the center of the screen.

To put the entire screen, including the right side background, on the left side of the boundary, set the horizontal color boundary to 44.

BACKGROUND COLOR

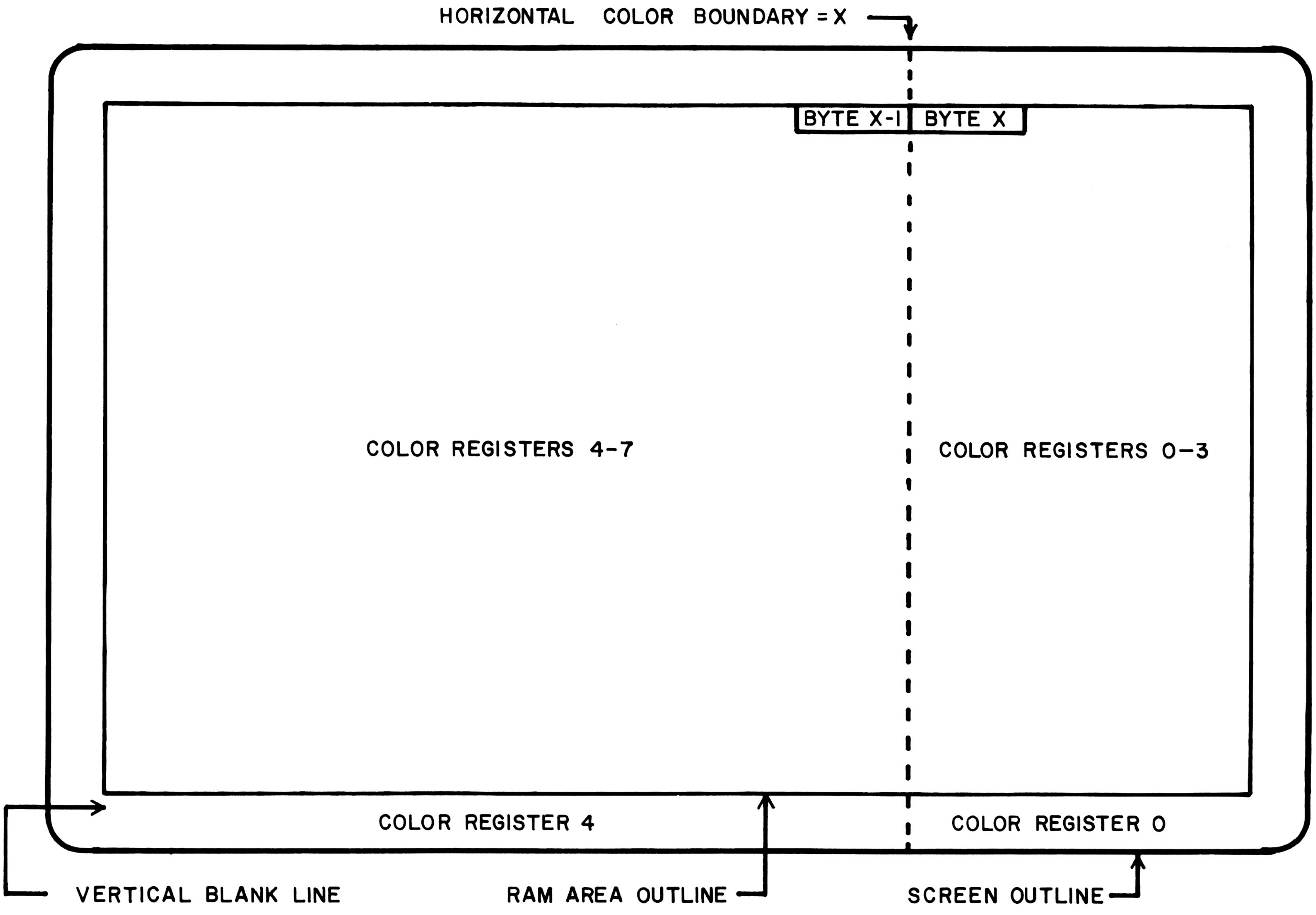
On most television the area defined by RAM is slightly smaller than the screen. There is generally extra space on all four sides of the RAM area. The color and intensity of this area is defined by the background color number (bits 6 and 7 of port 9). These two bits, along with the LEFT/RIGHT bit point to one of the color registers which determines the color and intensity.

VERTICAL BLANK

The Vertical Blank Register (output port AH) contains the line number on which vertical blanking will begin. In the low-resolution system bit Ø should be set to Ø and the line number should be in bits 1-7. In the high-resolution system the line number is in bits Ø-7. The background color will be displayed from the vertical blank line to the bottom of the screen. This allows the RAM that would normally be displayed in that area to be used for scratch pad. If the vertical blank register is set to Ø the entire RAM can be used for scratch pad. In a low-resolution system the register must be set to 101 or less; in a high-resolution system it must be set to 203 or less.

SUMMARY

The following color register map shows which color registers are used to define colors in different areas of the screen. The map assumes the background color is set to Ø. If it were set to 1 then color registers 1 and 5 would be used for background instead of Ø and 4. In the low-resolution system the color boundary is between bytes X and X-1. In the high-resolution system the boundary is between bytes 2X and 2X-1.



COLOR REGISTER MAP

INTERRUPT FEEDBACK

When the Z-80 acknowledges an interrupt it reads 8 bits of data from the data bus. It then uses this data as an instruction or an address. In the Bally Professional Arcade this data is determined by the contents of the interrupt feedback register (output port DH). In responding to a screen interrupt the contents of the interrupt feedback register are placed directly on the data bus. In responding to a light pen interrupt the lower four bits of the data bus are set to Ø and the upper four bits are the same as the corresponding bits of the feedback register.

INTERRUPT CONTROL BITS

In order for the Z-80 to be interrupted the internal interrupt enable flip-flop must be set by an EI instruction and one or two of the external interrupt enable bits must be set (output port EH). If bit 1 is set, light pen interrupts can occur. If bit 3 is set, screen interrupts can occur. If both bits are set, both interrupts can occur and the screen interrupt has higher priority.

The interrupt mode bits determine what happens if an interrupt occurs when the Z-80's interrupt enable flip-flop is not set. Each of the two interrupts may have a different mode. In mode Ø the Z-80 will continue to be interrupted until it finally enables interrupts and acknowledges the interrupt. In mode 1 the interrupt will be discarded if it is not acknowledged by the next instruction after it occured. If mode 1 is used the software must be designed such that the system will not be executing certain Z-80 instructions when the interrupt occurs. The opcodes of these instructions begin with CBH, DDH, EDH, and FDH.

The mode bit for light pen interrupt is bit Ø of port EH and the mode bit for screen interrupt is bit 2 of port EH.

SCREEN INTERRUPT

The purpose of the screen interrupt is to synchronize the software with the video system. The software must send a line number to the interrupt line register (output port FH). In the low-resolution system bit Ø is set to Ø and the line number is sent to bits 1-7. In the high-resolution system the line number is sent to bits 0-7. If the screen interrupt enable bit is set, the Z-80 will be interrupted when the video system completes scanning the line in the interrupt register. This interrupt can be used for timing since each line is scanned 60 times a second. It can also be used in conjunction with the color registers to make as many as 256 color-intensity combinations appear on the screen at the same time.

LIGHT PEN INTERRUPT

The light pen interrupt occurs when the light pen trigger is pressed and the video scan crosses the point on the screen where the light pen is. The interrupt routine can read two registers to determine the position of the light pen. The line number is read from the vertical feedback register (input port EH). In the high-resolution system the line number is in bits Ø-7. In the low-resolution system the line number is in bits 1-7, bit Ø should be ignored. The horizontal position of the light pen can be determined by reading input port FH and subtracting 8. In the low-resolution system the resultant value is the pixel number, Ø to 159. In the high-resolution system the resultant must be multiplied by two to give the pixel number, Ø to 358.

MAGIC REGISTER

As described earlier, the Magic System is enabled when data is written to a memory location (X) from Ø to 16K. A modified form of the data is actually written in memory location X+16K. The magic register (output port CH) determines how the data is modified. The purpose of each bit of the magic register is shown below.

Bit Ø	LSB of shift amount
1	MSB of shift amount
2	Rotate
3	Expand
4	OR
5	XOR
6	Flop

The order is which magic functions are performed is as follows: Expansion is done first; rotating or shifting; flopping; OR or XOR. As many as four can be used at any one time and any function can be bypassed. Rotate and shift as well as OR and XOR cannot be done at the same time.

EXPAND

The expander is used to expand the 8 bit data bus into 8 pixels (or 16 bits). It expands a Ø on the data bus into a two-bit pixel and a 1 into another two-bit pixel. Thus, two-color patterns can be stored in ROM in half the normal memory space.

During each memory write instruction using the expander, either the upper half or the lower half of the data bus is expanded. The half used is determined by the expand flip-flop. The flip-flop is reset by an output to the magic register and is toggled after each magic memory write. The upper half of the data bus is expanded when the flip-flop is Ø, and the lower half when the flip-flop is 1.

The expand register (output port 19H) determines the pixel values into which the data bus will be expanded. A Ø on the data bus will be expanded into the pixel defined by bits Ø and 1 of the expand register. A 1 on the data bus will be expanded into the pixel defined by bits 2 and 3 of the expand register.

The pixels generated by bit Ø or 4 of the data bus will be the least significant pixel of the expanded byte. The most significant pixel will come from bit 3 or 7.

SHIFTER

The shifter, flopper, and rotator operate on pixels rather than bits. Each byte is thought of as containing four pixels, each of which has one of four values. The four pixels are referred to as PØ, P1, P2, and P3. PØ is composed of the first two bits of the byte.

The shifter shifts data Ø, 1, 2, or 3 pixels to the right. The shift amount is determined by bits Ø and 1 of the magic register. The pixels that are shifted out of one byte are shifted into the next byte. Ø's are shifted into the first byte of a sequence. The shifter assumes the first byte of a sequence is the first magic memory write after an output to the magic register. Each sequence must be initialized by an output to the magic register and data cannot be sent to the magic register in the middle of a sequence.

FLOPPER

The output of the flopper is a mirror image of it's input. Pixel Ø and 3 exchange values as do pixel 1 and 2.

The diagrams on the following page show examples of shifting and flopping.

BYTE 0				BYTE 1				BYTE 2				
P3	P2	P1	P0	P7	P6	P5	P4	P11	P10	P9	P8	ORIGINAL DATA
0	P3	P2	P1	P0	P7	P6	P5	P4	P11	P10	P9	SHIFT 1
0	0	P3	P2	P1	P0	P7	P6	P5	P4	P11	P10	SHIFT 2
0	0	0	P3	P2	P1	P0	P7	P6	P5	P4	P11	SHIFT 3
P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	FLOPPED

SHIFTER — FLOPPER

ROTATOR

The rotator is used to rotate a 4 X 4 pixel image 90^{o} in a clockwise direction. The rotator is initialized by an output to the magic register and will re-initialize itself after every eight writes to magic memory. To perform a rotation, the following procedure must be performed twice. Write the top byte of the unrotated image to a location in magic memory. Write the next byte to the first location plus 80, the next byte to the first location plus 160, and the last byte to the first location plus 240. After eight writes the data will appear in RAM and on the screen rotated 90^{o} from the original image.

The rotator can only be used in commercial mode.

The diagram on the following page shows an example of rotating.

P3	P2	P1	P0
P7	P6	P5	P4
P11	P10	P9	P8
P15	P14	P13	P12

ORIGINAL

P15	P11	P7	P3
P14	P10	P6	P2
P13	P9	P5	P1
P12	P8	P4	P0

ROTATED

ROTATOR

OR AND XOR

These functions operate on a byte as 8-bits rather than four pixels. When the OR function is used in writing data to RAM, the input to the OR circuit is ORed with the contents of the RAM location being accessed. The resultant is then written in RAM.

The XOR function operates in the same way except that the data is XORed instead of ORed.

INTERCEPT

Software reads the intercept register (input port 8H) to determine if an intercept occured on an OR or XOR write. An intercept is defined as the writing of a non-zero pixel in a pixel location that previously contained a non-zero pixel. A non-zero pixel is a pixel with a value of Ø1, 1Ø, or 11. A 1 in the intercept register means an intercept has occured. Bits Ø - 3 give the intercept information for all OR or XOR writes since the last input from the intercept register. An input from the intercept register resets these bits. A bit is set to 1 if an intercept occurs in the appropriate position and will not be reset until after the next intercept register input.

Bit	
Ø	Intercept in pixel 3 in an OR or XOR write since last reset
1	Intercept in pixel 2 in an OR or XOR write since last reset
2	Intercept in pixel 1 in an OR or XOR write since last reset
3	Intercept in pixel Ø in an OR or XOR write since last reset
4	Intercept in pixel 3 in last OR or XOR write
5	Intercept in pixel 2 in last OR or XOR write
6	Intercept in pixel 1 in last OR or XOR write
7	Intercept in pixel Ø in last OR or XOR write

PLAYER INPUT

The system will accomodate up to four player control handles at once. Each handle has five switches and a potentiometer. The switches are read by the Z-80 on input ports 10H - 13H and are not debounced. The switches are normally open and normally feedback Ø's.

The signals from the potentiometers are changed to digital information by an 8-bit Analog-to-Digital Convertor. The four pots are on input ports 1CH - 1FH. All Ø's are fedback when the pot is turned fully counter-clockwise and all 1's when turned fully clockwise.

The 24-button keypad is read on bits Ø-5 of ports 14H-17H. The data is normally Ø and if more than one button is depressed, the data should be ignored. The keypad will not send back the proper data if any of the player control switches are closed. Here again, the buttons are not debounced.

Player control inputs are shown on the following page.

PLAYER INPUT

PORT ↓	7	6	5	4	3	2	1	0 ← BIT	
10H				TRIG	RIGHT	LEFT	DOWN	UP	PLAYER 1
11H				TRIG	RIGHT	LEFT	DOWN	UP	PLAYER 2
12H				TRIG	RIGHT	LEFT	DOWN	UP	PLAYER 3
13H				TRIG	RIGHT	LEFT	DOWN	UP	PLAYER 4
14H			=	+	−	X	÷	%	KEYPAD
15H			.	3	6	9	CH	∨	KEYPAD
16H			0	2	5	8	MS	∧	KEYPAD
17H			CE	1	4	7	MR	C	KEYPAD
1CH	← POT →								PLAYER 1
1DH	← POT →								PLAYER 2
1EH	← POT →								PLAYER 3
1FH	← POT →								PLAYER 4

MASTER OSCILLATOR

The frequency of the master oscillator is determined by the contents of several output ports. Port 1ØH sets the master frequency. It is given by the following formula:

$$F_m = \frac{1789}{\text{PORT } 10H + 1} \text{ Khz}$$

If bit 4 of output port 15H is set to 1, the master oscillator frequency will be modulated by noise. The amount of modulation will be set by the 8-bit noise volume register, output port 17H.

If bit 4 of output port 15H is set to Ø, the frequency of the master oscillator will be modulated by a constant value to give a vibrato effect. The amount of modulation will be set by the vibrato depth register (the first 6 bits of output port 14H). The speed of modulation is set by the vibrato speed register (upper 2 bits of output port 14H); ØØ for fastest and 11 for slowest.

Frequency modulation is accomplished by adding a modulation value to the contents of port 1ØH and sending the result to the master oscillator frequency generator. In noise modulation, the modulation value is an 8-bit word from the noise generator. If a bit in the noise volume register is set to Ø, the corresponding bit in the modulation value word will be set to Ø. In vibrato modulation, the modulation value alternates between Ø and the contents of the vibrato volume register.

Modulation can be completely disabled by setting the master volume to Ø if noise modulation is being used, or by setting the vibrato depth to Ø when vibrato is used.

TONES

The system contains three tone generators each clocked by the same master oscillator. The frequency of Tone A is set by output port 11H, Tone B by output port 12H, and Tone C by output port 13H. The frequency is given by the following formula:

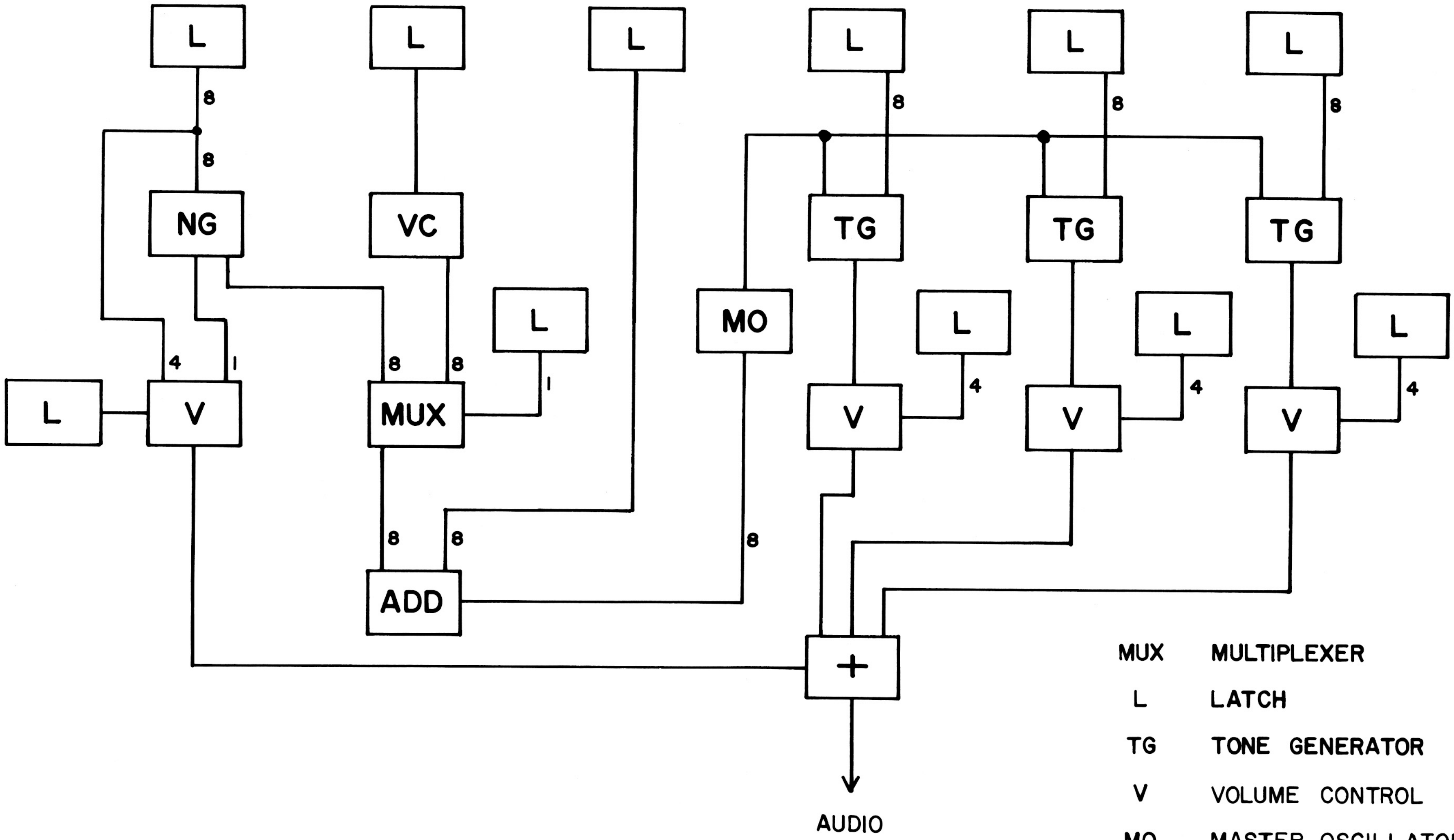
$$F_t = \frac{F_m}{2(\text{contents of TONE PORT} + 1)} = \frac{894}{(\text{PORT 10H} + 1)(\text{contents of TONE PORT} + 1)} \text{ Khz}$$

The tone volumes are controlled by output ports 15H and 16H. The lower 4 bits of port 16H set Tone A Volume, the upper 4 bits sets Tone B Volume. The lower 4 bits of port 15H sets Tone C Volume. Noise can be mixed with the tones by setting bit 5 of port 15H to 1. In this case the noise volume is given by the upper 4 bits of port 17H. In all cases a volume of Ø is silence and a volume of all 1's is loudest.

SOUND BLOCK TRANSFER

All 8 bytes of sound control can be sent to the audio circuit with one OTIR instruction. Register C should be sent to 18H, register B to 8H and HL pointing to the 8 bytes of data. The data pointed to by HL goes to port 17H and the next 7 bytes of data goes to ports 16H through 1ØH.

HL →	Memory Location	X	Data-to-port	17H
		X+1	Data-to-port	16H
		X+2	Data-to-port	15H
		X+3	Data-to-port	14H
		X+4	Data-to-port	13H
		X+5	Data-to-port	12H
		X+6	Data-to-port	11H
		X+7	Data-to-port	1ØH



MUX	MULTIPLEXER
L	LATCH
TG	TONE GENERATOR
V	VOLUME CONTROL
MO	MASTER OSCILLATOR
VC	VIBRATO CONTROL
NG	NOISE GENERATOR
ADD	ADDER

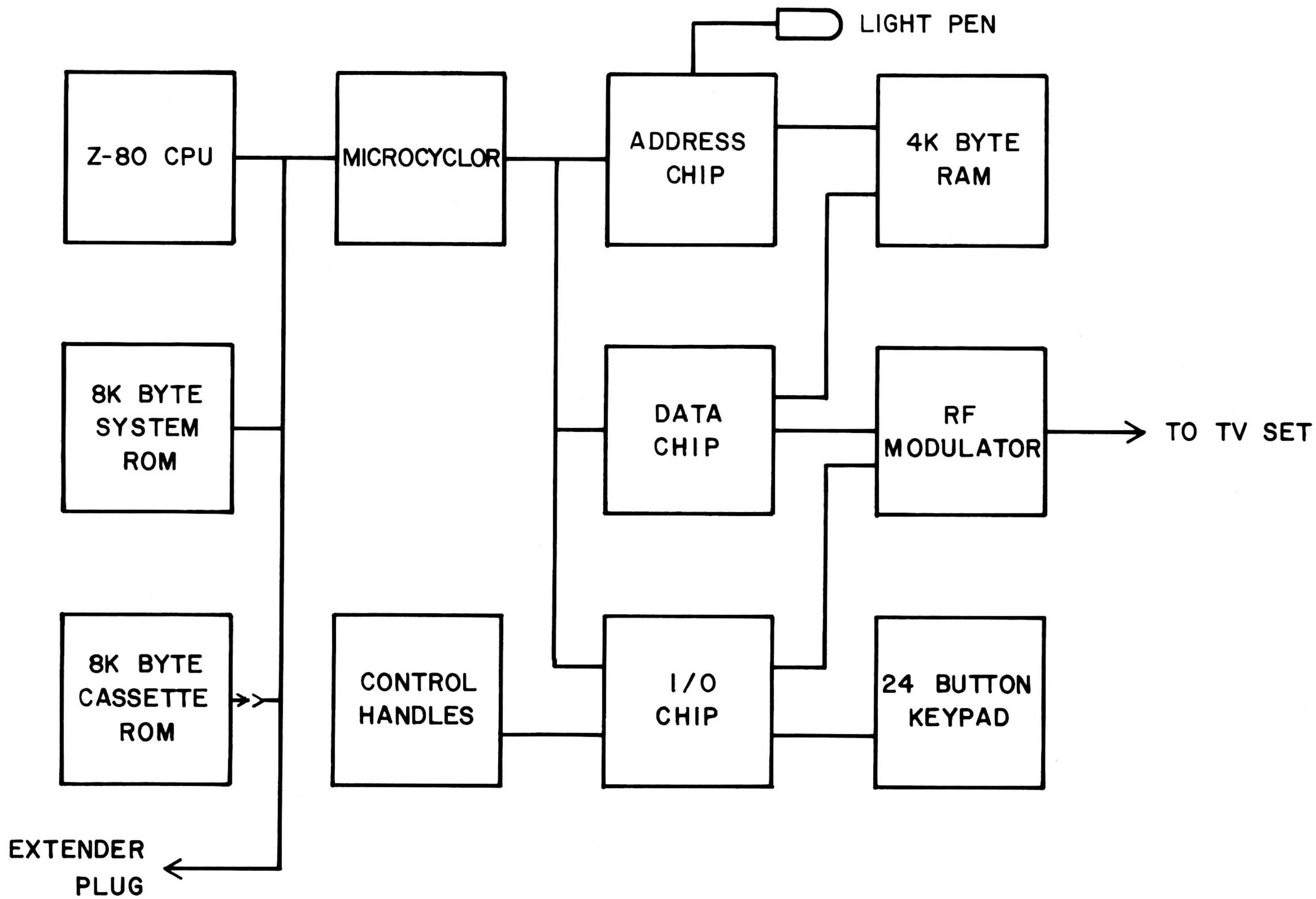
AUDIO GENERATOR BLOCK DIAGRAM

OUTPUT PORTS

PORT NUMBER	FUNCTION
ØH	Color Register Ø
1H	Color Register 1
2H	Color Register 2
3H	Color Register 3
4H	Color Register 4
5H	Color Register 5
6H	Color Register 6
7H	Color Register 7
8H	Low/High Resolution
9H	Horizontal Color Boundary, Background Color
AH	Vertical Blank Register
BH	Color Block Transfer
CH	Magic Register
DH	Interrupt Feedback Register
EH	Interrupt Enable and Mode
FH	Interrupt Line
1ØH	Master Oscillator
11H	Tone A Frequency
12H	Tone B Frequency
13H	Tone C Frequency
14H	Vibrato Register
15H	Tone C Volume, Noise Modulation Control
16H	Tone A Volume, Tone B Volume
17H	Noise Volume Register
18H	Sound Block Transfer
19H	Expand Register

INPUT PORTS

PORT NUMBER	FUNCTION
8H	Intercept Feedback
EH	Vertical Line Feedback
FH	Horizontal Address Feedback
1ØH	Player 1 Handle
11H	Player 2 Handle
12H	Player 3 Handle
13H	Player 4 Handle
14H	Keypad Column Ø (right)
15H	Keypad Column 1
16H	Keypad Column 2
17H	Keypad Column 3 (left)



SYSTEM BLOCK DIAGRAM

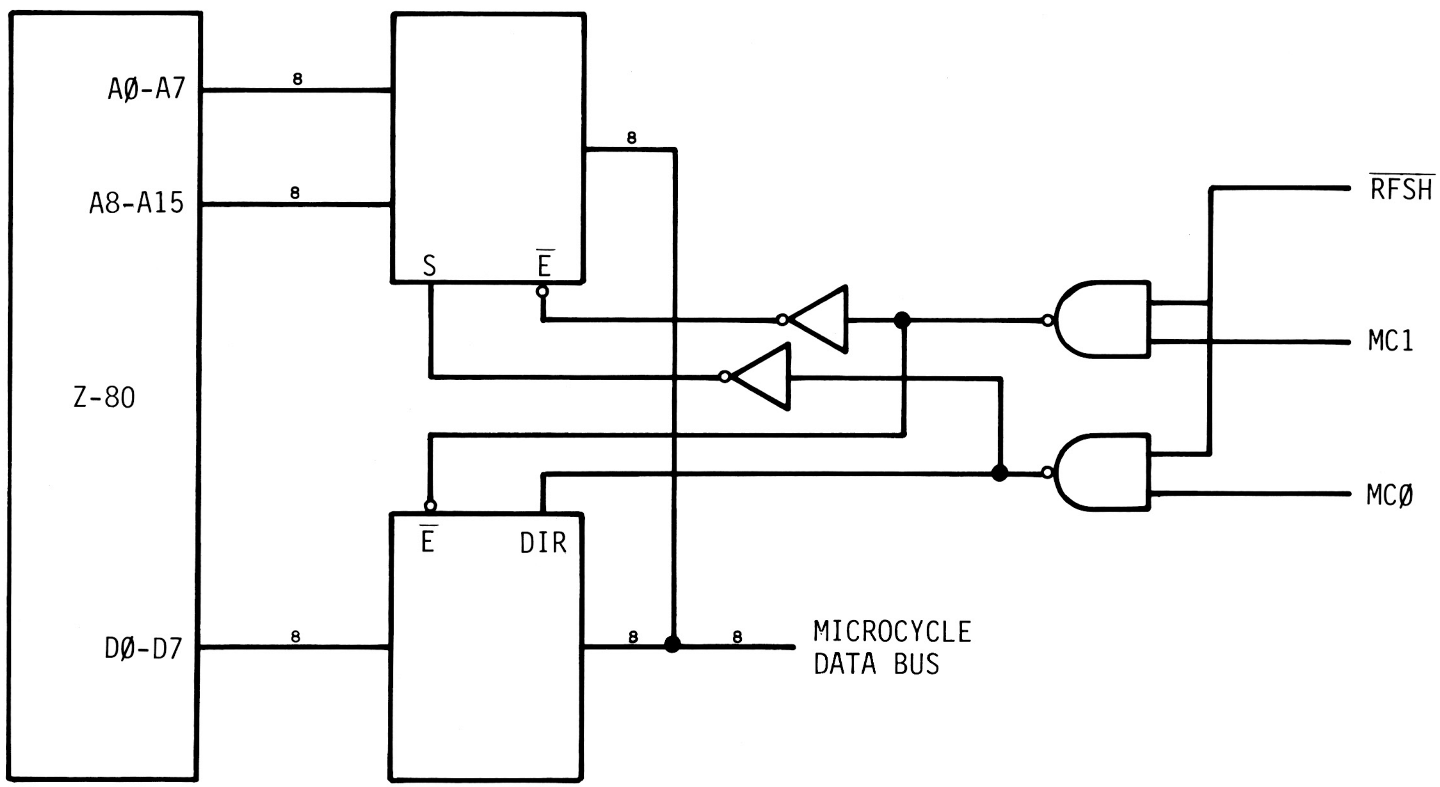
MICROCYCLER

The purpose of the microcycler is to combine the 16-bit Address Bus and the 8-bit Data Bus from the Z-8Ø into one 8-bit Microcycle Data Bus to the Data Chip, Address Chip, and I/O Chip. This was done to reduce the pin count on the custom chips.

The Microcycle Data Bus can be in any of four modes. Its mode is controlled by MCØ and MC1 coming from the Data Chip and $\overline{\text{RFSH}}$ from the Z-8Ø. The modes are shown below.

$\overline{\text{RFSH}}$	MCØ	MC1	Microcycle Data Bus Contents
Ø	Ø	Ø	AØ - A7 from Z-8Ø
Ø	Ø	1	AØ - A7 from Z-8Ø
Ø	1	Ø	AØ - A7 from Z-8Ø
Ø	1	1	AØ - A7 from Z-8Ø
1	Ø	Ø	AØ - A7 from Z-8Ø
1	Ø	1	A8 - A15 from Z-8Ø
1	1	Ø	DØ - D7 from Z-8Ø
1	1	1	DØ - D7 to Z-8Ø

MCØ and MC1 change 140 nsec after the rising edge of Φ. Their changes are shown in the timing diagrams of various instruction cycles.



MICROCYCLER BLOCK DIAGRAM

ADDRESS CHIP DESCRIPTION

The Microcycle Decoder generates twelve bits of Z-8Ø address from the 8-bit Microcycle Data Bus. This address is then fed through MUX I and MUX II to MAØ-5 which go to the RAM. The Scan Address Generator generates a 12-bit address which is used to read video data from the RAM. This address goes from Ø to FFFH once every frame (1/60 sec.).

MUX I sends either the Scan Address or Z-8Ø Address to its 12 outputs. An output of the Scan Address Generator controls MUX I. If the Scan Address Generator and the Z-8Ø request a memory cycle at the same time, the Scan Address Generator will have higher priority and the Z-8Ø will be required to wait (by the $\overline{\text{WAIT}}$ output). The Scan Address Generator never requires the memory for more than one consecutive memory cycle, so the Z-8Ø is never required to wait for the memory for more than one cycle. HORIZ DR and VERT DR synchronize the Scan Address Generator with the Data Chip and the TV Scan.

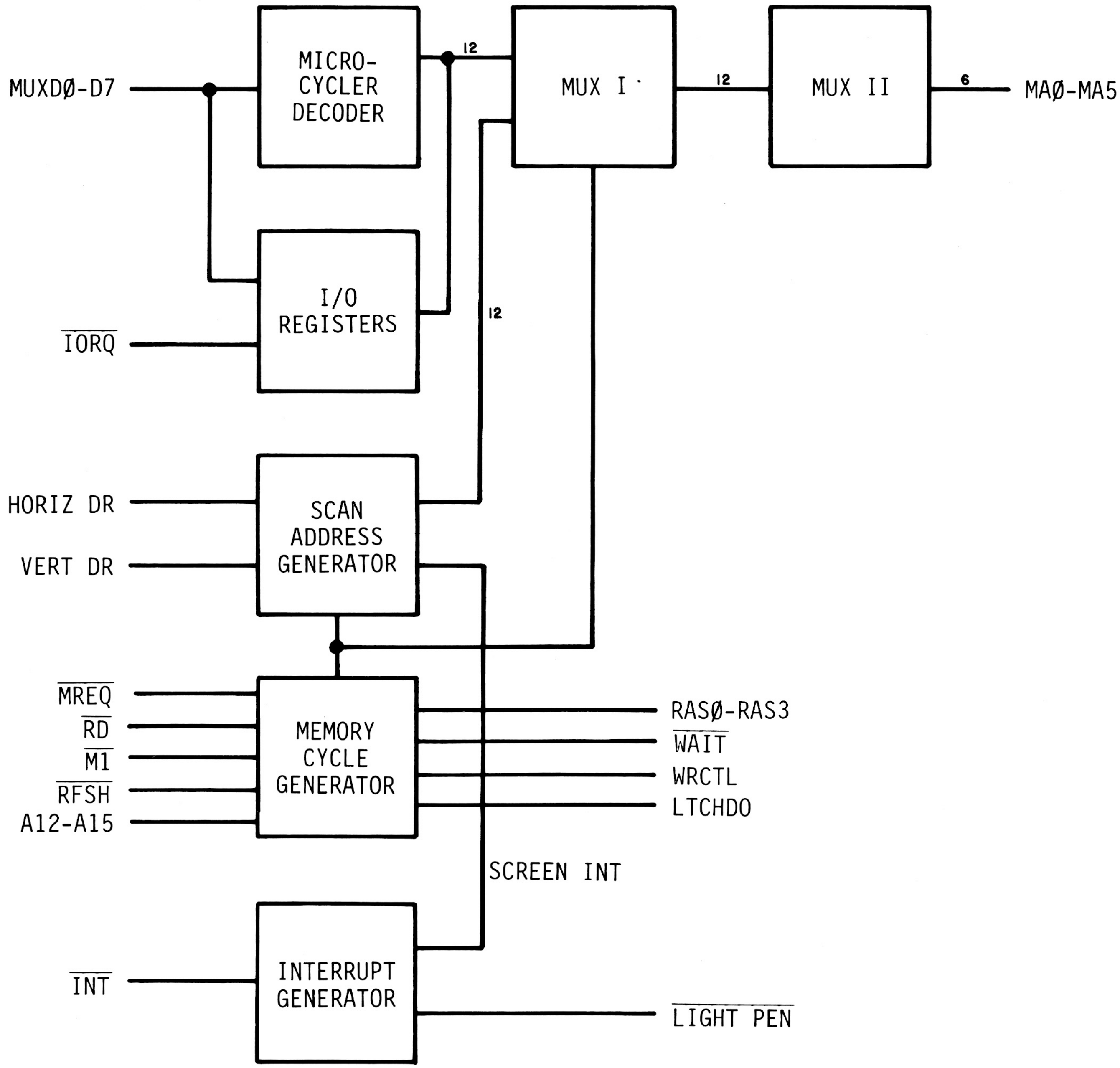
The purpose of MUX II is to multiplex its 12 inputs to the six address bits in the two time slices required for 4K x 1 16 pin RAMS.

The Memory Cycle Generator controls memory cycles generated by either the Z-8Ø or Scan Address Generator. $\overline{\text{MREQ}}$, $\overline{\text{RD}}$, $\overline{\text{M1}}$, $\overline{\text{RFSH}}$, and A12-A15 are from the Z-8Ø. A12-A15 are fed directly from the Z-8Ø because if they were brought out of the microcycle decoder, they would arrive too late in the memory cycle. The RASØ - RAS3 outputs are used to activate memory cycles. In the consumer game, only RASØ is used to one bank of RAM (4K x 8). In the commercial game, all four RAS's are used to control four banks of RAM (16K x 8). WRCTL and LTCHDO are control signals to the Data Chip. WRCTL tells the Data Chip when to place data to be written to memory on the memory data bus. LTCHDO tells the Data Chip when valid data from RAM is present on the memory data bus.

As mentioned earlier, $\overline{\text{WAIT}}$ is generated when the Z-80 and Scan Address Generator both request memory at the same time. $\overline{\text{WAIT}}$ is also generated for one cycle every time the Z-80 requests a memory access, even if there is no conflict with the Scan Address. This is because the microcycler slows down Z-80 memory accesses. The Z-80 address bus and data bus must time share the microcycle bus so the Z-80 data reaches the microcycle bus very late in the memory cycle.

The INT Generator generates two types of interrupts to the Z-80; Light Pen and Screen interrupts. A screen interrupt is generated when screen interrupts are enabled and the TV scan completes a certain line on the screen (from 0 to 255). The line at which the interrupt will occur is determined by the Z-80. This interrupt can be used for timing since the TV rescans every line once every 1/60 sec. A light pen interrupt occurs when the light pen interrupt is enabled and $\overline{\text{LIGHT PEN}}$ goes low. The current scan address is saved in latches in the Scan Address Generator. The Z-80 can read the contents of these latches to determine the scan address at the time $\overline{\text{LIGHT PEN}}$ was activated and thus the position of the light pen on the screen.

The I/O Decode circuit is used during Z-80 input and output instructions. Z-80 input instructions are used to read the scan address after light pen interrupts. Output instructions are used to enable the two interrupts and set the line number for screen interrupts.



ADDRESS CHIP BLOCK DIAGRAM

DATA CHIP DESCRIPTION

The TV Sync Generator uses 7M and $\overline{7M}$ (7.159090 Mhz square waves) to generate NTSC standard sync and blank to be sent to the Video Generator. It also generates HORIZ DR and VERT DR for synchronization with the Address Chip. HORIZ DR occurs once every horizontal line (63.5 usec), and VERT DR occurs once every frame (16.6 msec).

The Shift Register loads parallel data from the memory data bus (MDØ - MD7) and shifts it out of its two serial outputs. The TV sync Generator controls when data is loaded or shifted. In a consumer game,the two outputs of the shift register are sent through MUX I to MUX II. In a commercial game, SERIAL Ø and SERIAL 1 are sent through the MUX I to MUX II. The two bits from MUX I select 8 bits to be sent through MUX II to the Video Generator. These 8 bits then determine the analog values of VIDEO, R-Y, and B-Y. 2.5V is a 2.5V D C reference level.

The Clock Generator generates ØG and $\overline{PX}$ from 7M. These are the clocks for the rest of the system. The frequency of $\overline{PX}$ is half that of 7M and the frequency of ØG is half that of $\overline{PX}$.

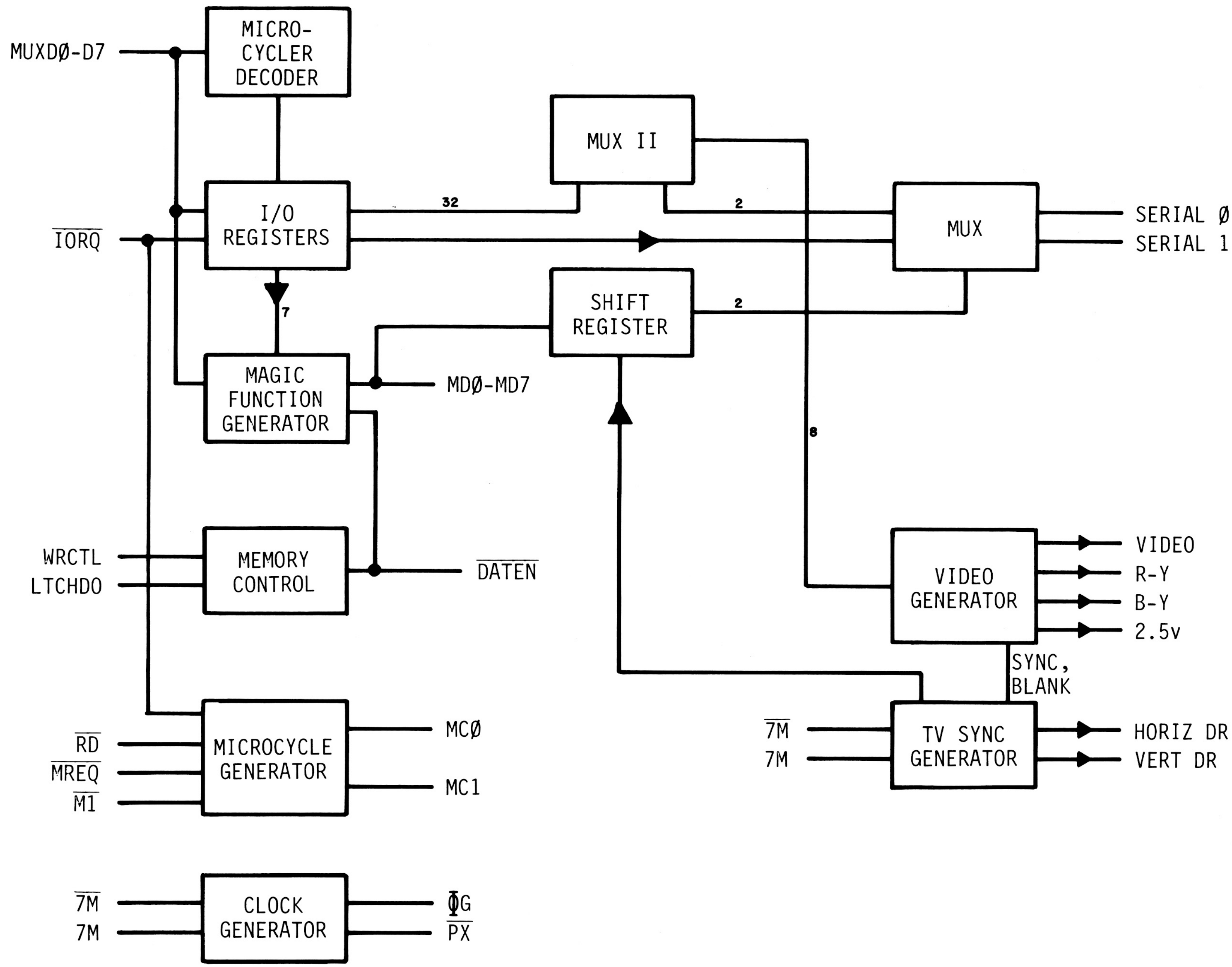
The Microcycle Generator generates the microcycle control bits, MCØ and MC1, from $\overline{IORQ}$, $\overline{MREQ}$, $\overline{RD}$, and $\overline{M1}$, all from the Z-8Ø.

In memory write cycles WRCTL is activated and the Memory Control circuit generates $\overline{DATEN}$. The Magic Function Generator takes the data from the Z-8Ø on MUXDØ - D7 and transfers it to MDØ - MD7. If a Magic write is being done, the Magic Function Generator will modify the data as required before it places it on the memory data bus.

A Magic write is a memory write cycle in which data is written to a location, (X) from Ø to 16K. All memory from Ø to 16K is ROM and cannot be modified. The data is modified by the Magic Function Generator and is written to location X + 16K. The way in which the data is modified is determined by the 7 bits coming from the I/O registers.

In memory reads, data is transferred from MDØ - MD7 to MUXDØ - MUXD7. Also, LTCHDO is activated which causes the data from RAM to be latched up in a register in the Magic Function Generator. This latched data is used in some magic functions.

The I/O registers are loaded by output instructions from the Z-8Ø just as in the Address Chip.



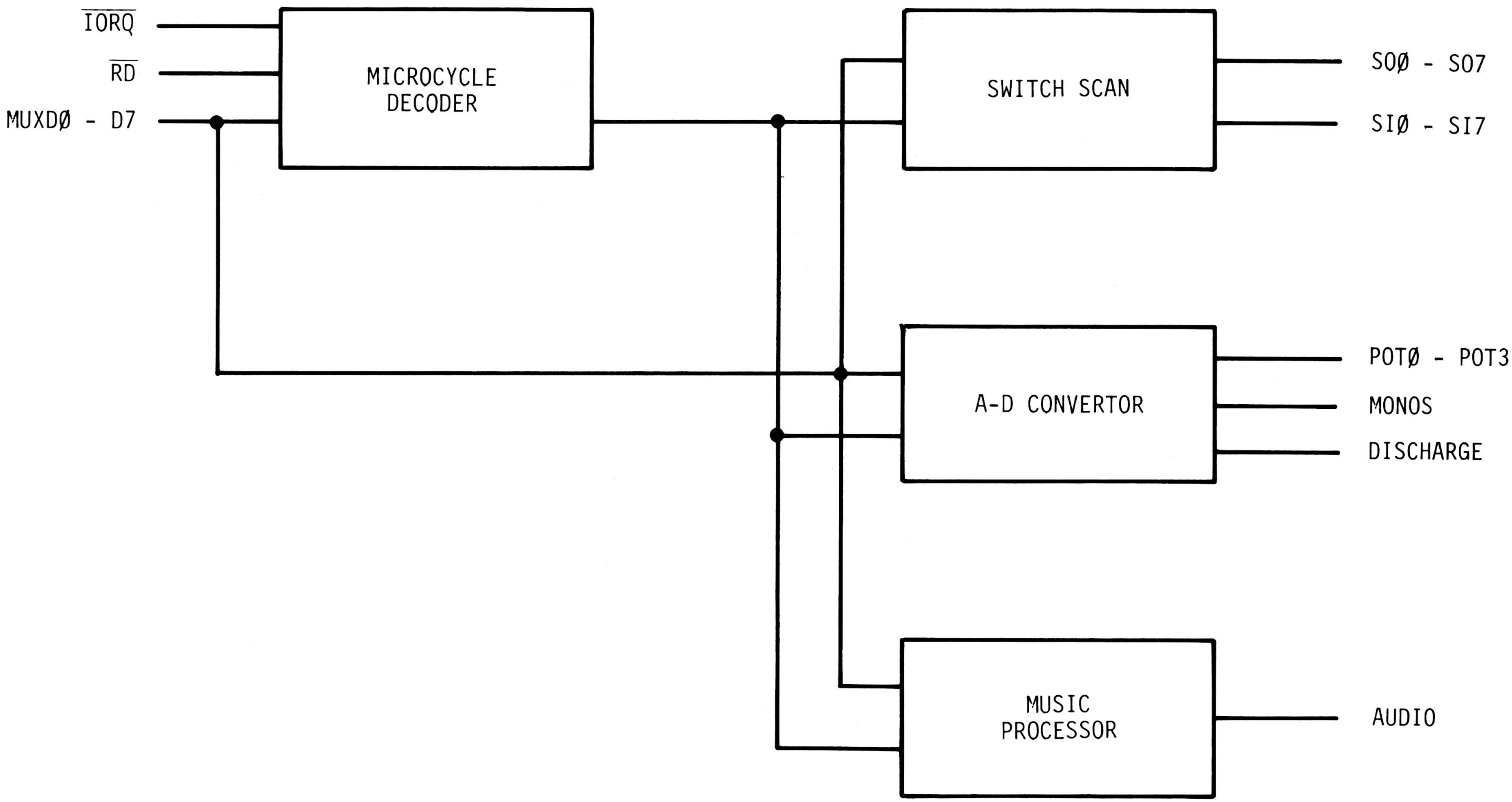
DATA CHIP BLOCK DIAGRAM

I/O CHIP DESCRIPTION

The Z-8Ø communicates with the I/O Chip through input and output instructions. The state of an 8 x 8 switch matrix can be read through the Switch Scan circuit. When an input instruction is executed, one of the SOØ-SO7 lines will be activated. When a line is activated, the switch matrix will feed back eight bits of data on SIØ-SI7. This data is in turn fed to the Z-8Ø through MUXDØ - MUXD7.

The Z-8Ø can read the position of four potentiometers (pots) through the A-D Converter circuit. The pots are continuously scanned by the A-D Converter and the results of the conversions are stored in a RAM in the A-D Converter circuit. The Z-8Ø simply reads this RAM with input instructions.

The Z-8Ø loads data into the Music Processor with output instructions. This data determines the characteristics of the audio that is generated. The Music Processor is described in detail below.



I/O CHIP BLOCK DIAGRAM

MUSIC PROCESSOR

The music processor can be divided into two sections. The first section generates the Master Oscillator Frequency and the second section uses the Master Oscillator Frequency to generate tone frequencies and the analog audio output. The contents of all registers in the Music Processor are set by output instructions from the Z-8Ø.

Master Oscillator Frequency is a square wave whose frequency is determined by the 8 binary inputs to the Master Oscillator. This 8-bit word is the sum of the contents of the Master Oscillator Register and the output of the MUX. The MUX is controlled by MUX REG.

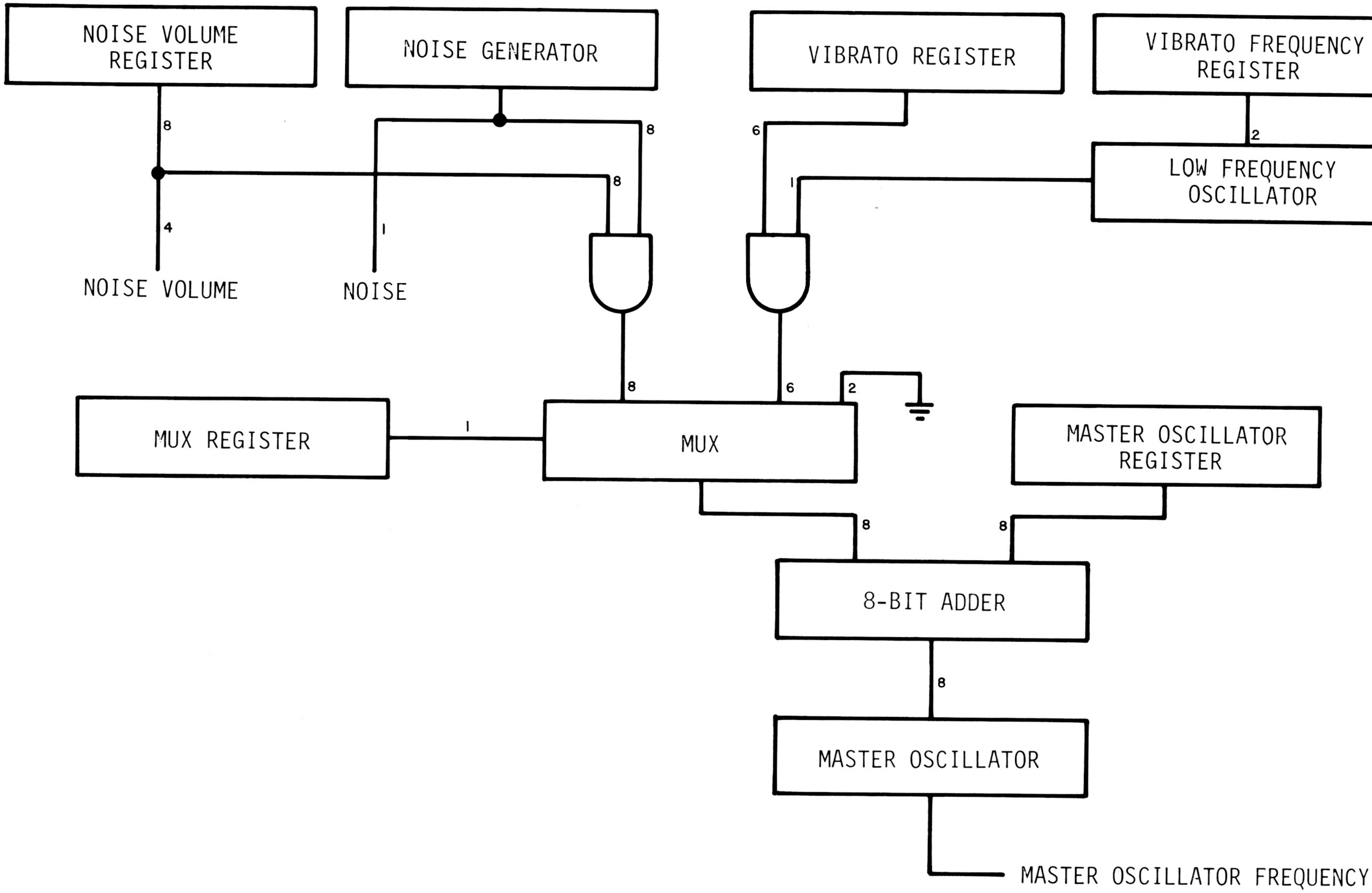
If MUX REG contains Ø,then data from the Vibrato System will be fed through the MUX. The two bits from the Vibrato Frequency Register determine the frequency of the square wave output of the Low Frequency Oscillator. The 6-bit word at the output of the AND gates oscillates between Ø and the contents of the Vibrato Register. The frequency of oscillation is determined by the contents of the Vibrato Frequency Register. The 6-bit word, along with two ground bits are fed through the MUX to the Adder. This causes the Master Oscillator Frequency to be modulated between two values thus giving a vibrato effect.

If MUX REG contains 1,then data from the Noise System will be fed through the MUX. The 8-bit word from the Noise Volume Register determines which bits from the Noise Generator will be present at the output of the AND gates.

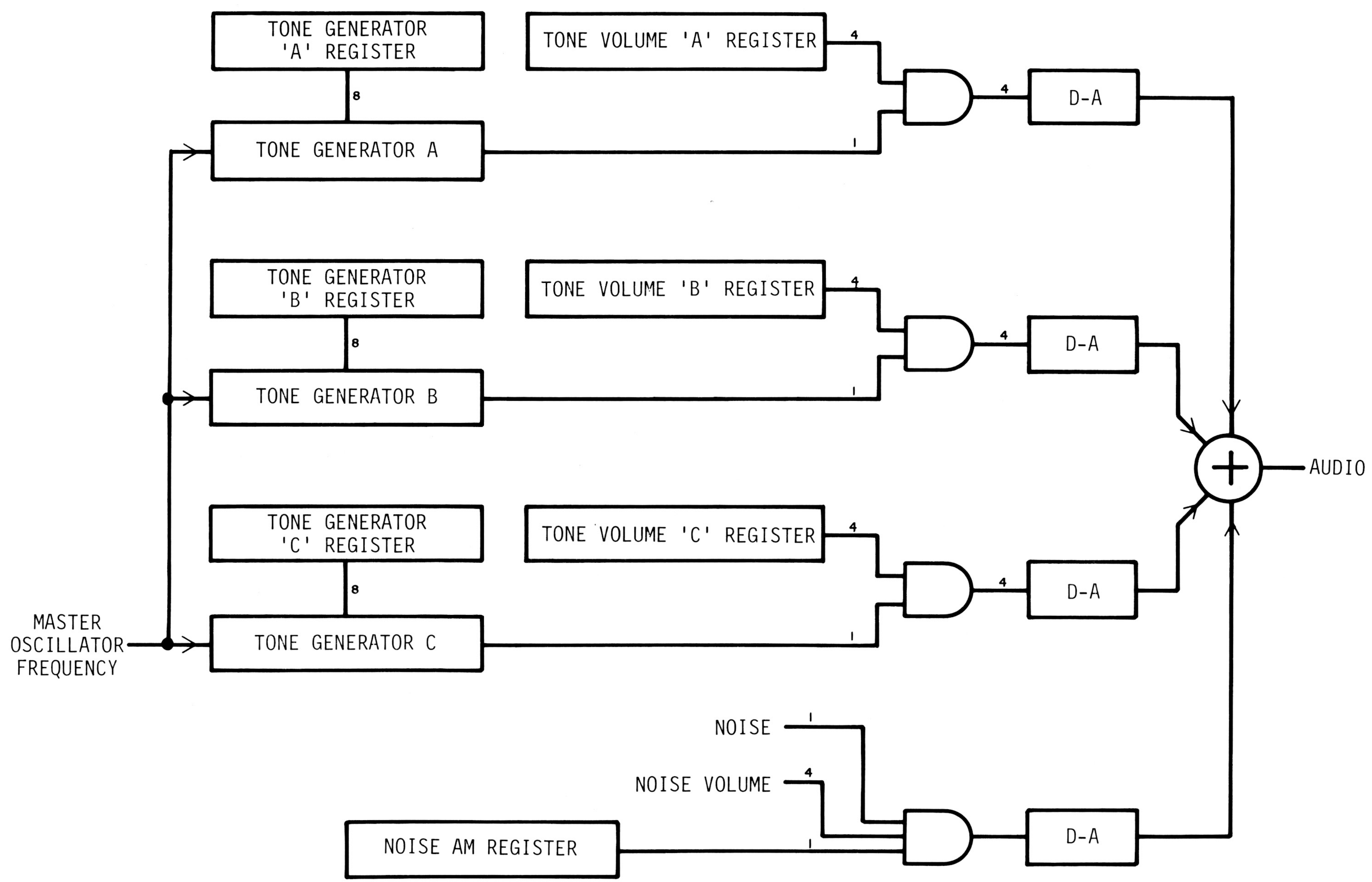
If a bit in the Noise Volume Register is Ø, then the corresponding bit at the output of the AND gates will be Ø. If a bit in the Noise Volume Register is 1, then the corresponding bit at the output of the AND gates will be noise from the Noise Generator. This 8-bit word is sent through the MUX to the Adder. The Master Oscillator Frequency is modulated by noise.

In the second part of the Music Processor, the square wave from the Master Oscillator is fed to three Tone Generator circuits which produce square waves at their outputs. The frequency of their outputs is determined by the contents of their Tone Generator Register and Master Oscillator Frequency. The 4-bit words at the output of the AND gates oscillate between Ø and the contents of the Tone Volume Register. These 4-bit words are sent to D-A Converters whose outputs oscillate between GND and a positive analog voltage determined by the contents of the Tone Volume Register.

One Noise bit and four Noise Volume bits from the first section of the Music Processor are fed to a set of AND gates. This set of AND gates operates the same way as the AND gates for the tones, except that the Noise AM Register must contain a 1 for the outputs of the AND gates to oscillate. The analog outputs of the four D-A Converters are summed to produce the single audio output.



MASTER OSCILLATOR



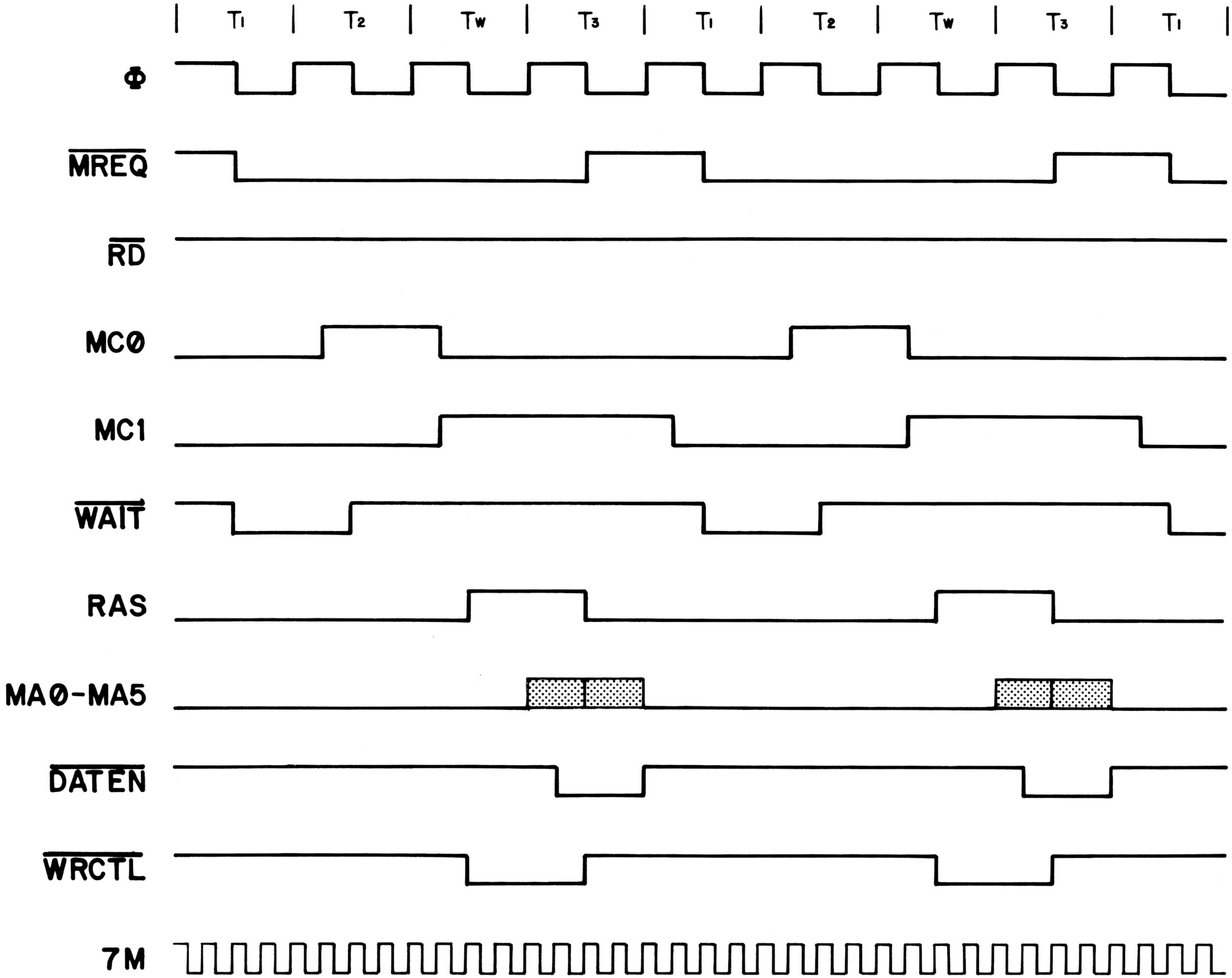
TONE GENERATORS

CUSTOM CHIP TIMING

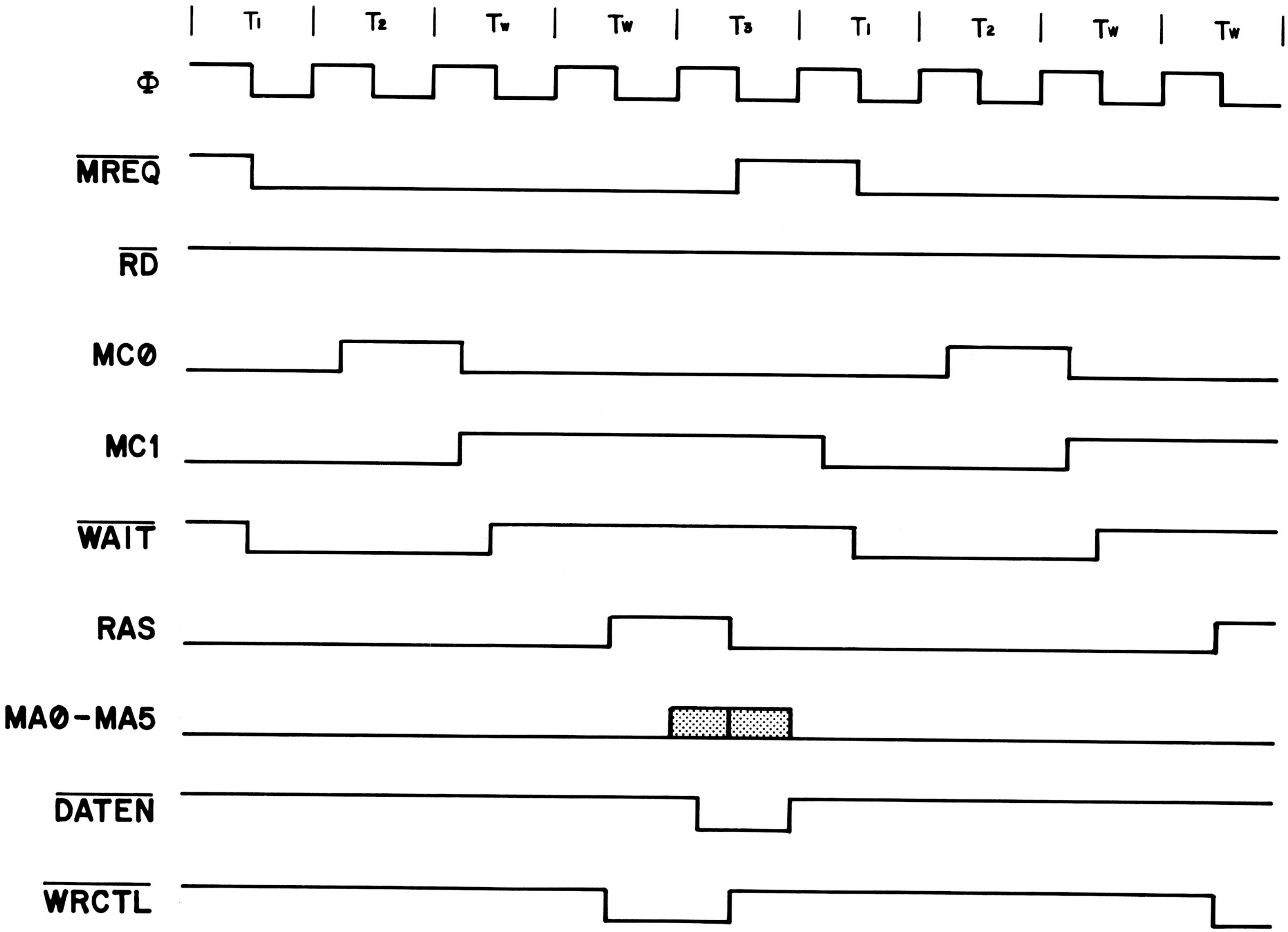
The following diagrams show the relationship of various signals in the system during different types of operations. Delays are shown to be zero nsec from the clock edge which causes the transition. The actual delay is given in "Electrical Specification for Midway Custom Circuits".

MUXDØ - MUXD7 is a 8-bit bidirectional address and data bus for the custom chips. By using this technique 16 bits of address and 8 bits of data can be sent to the custom chips on 8 wires. The state of the bus is determined by MCØ and MC1 from the data chip and $\overline{\text{RFSH}}$ from the Z-8Ø.

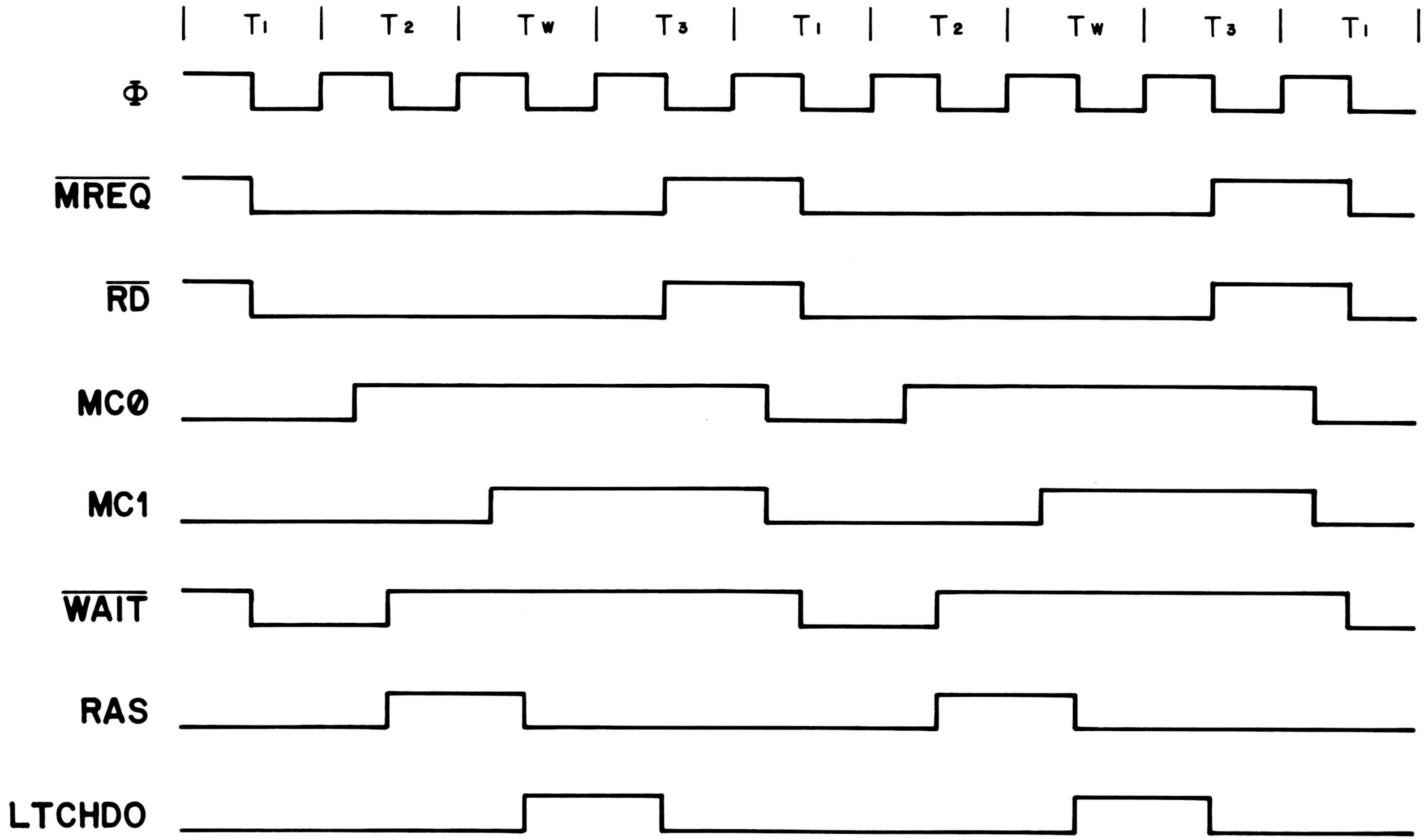
$\overline{\text{RFSH}}$	MC1	MCØ	
L	L	L	AØ - A7 to custom chips.
L	L	H	AØ - A7 to custom chips
L	H	L	AØ - A7 to custom chips
L	H	H	AØ - A7 to custom chips
H	L	L	AØ - A7 to custom chips
H	L	H	A8 - A15 to custom chips
H	H	L	DØ - D7 to custom chips
H	H	H	DØ - D7 from custom chips



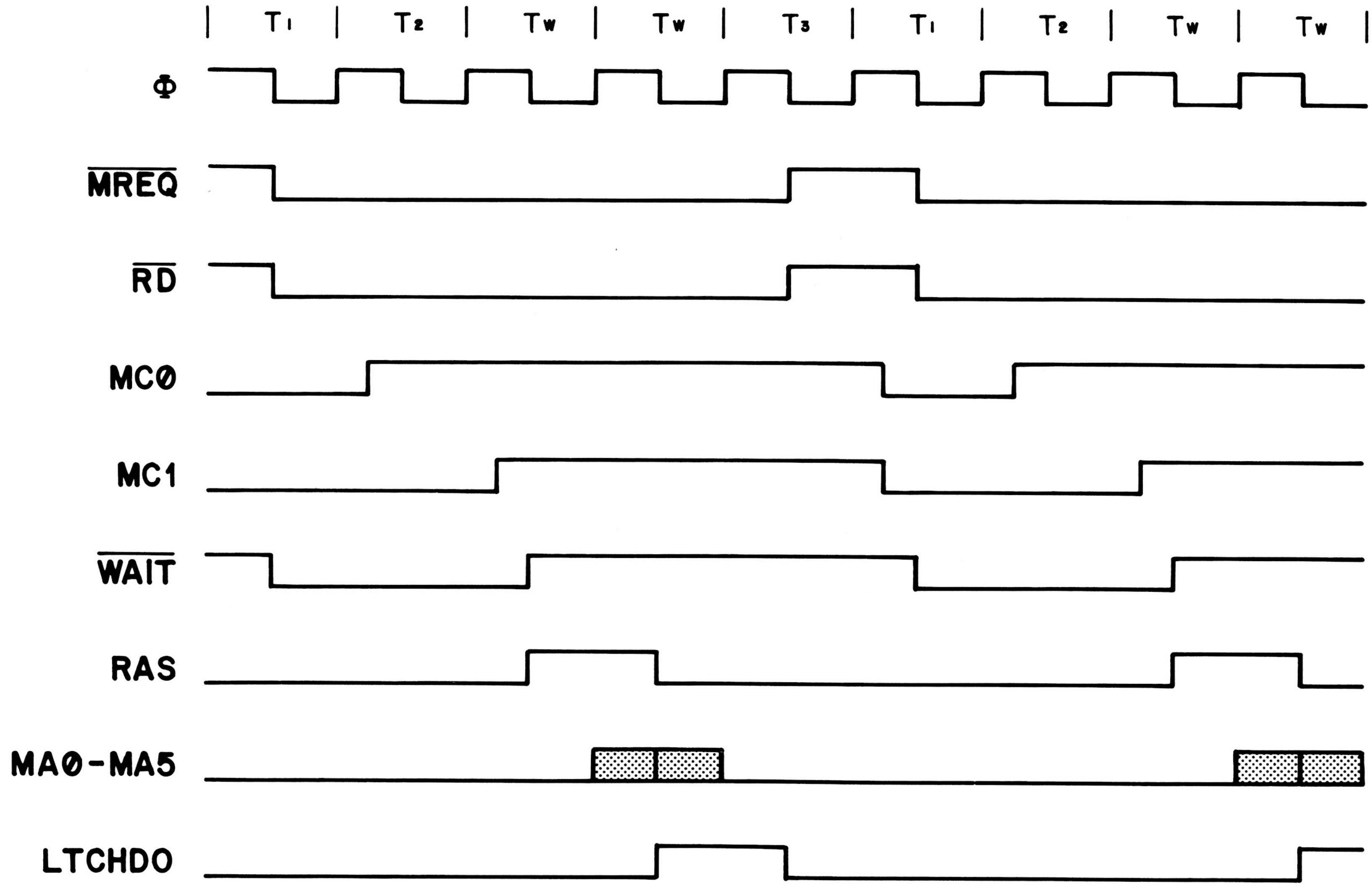
MEMORY WRITE WITHOUT EXTRA WAIT STATE



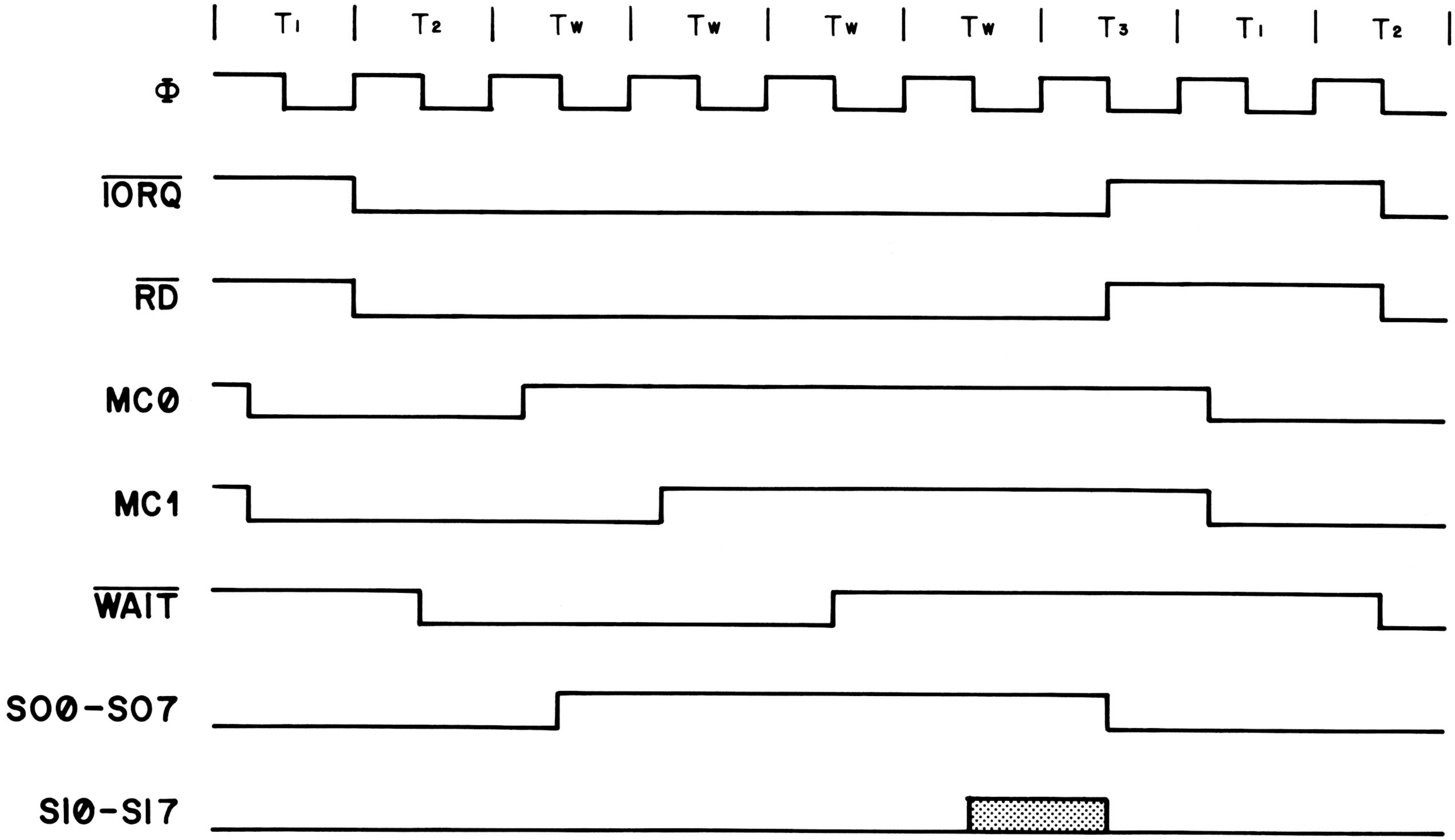
MEMORY WRITE WITH VIDEO WAIT STATE



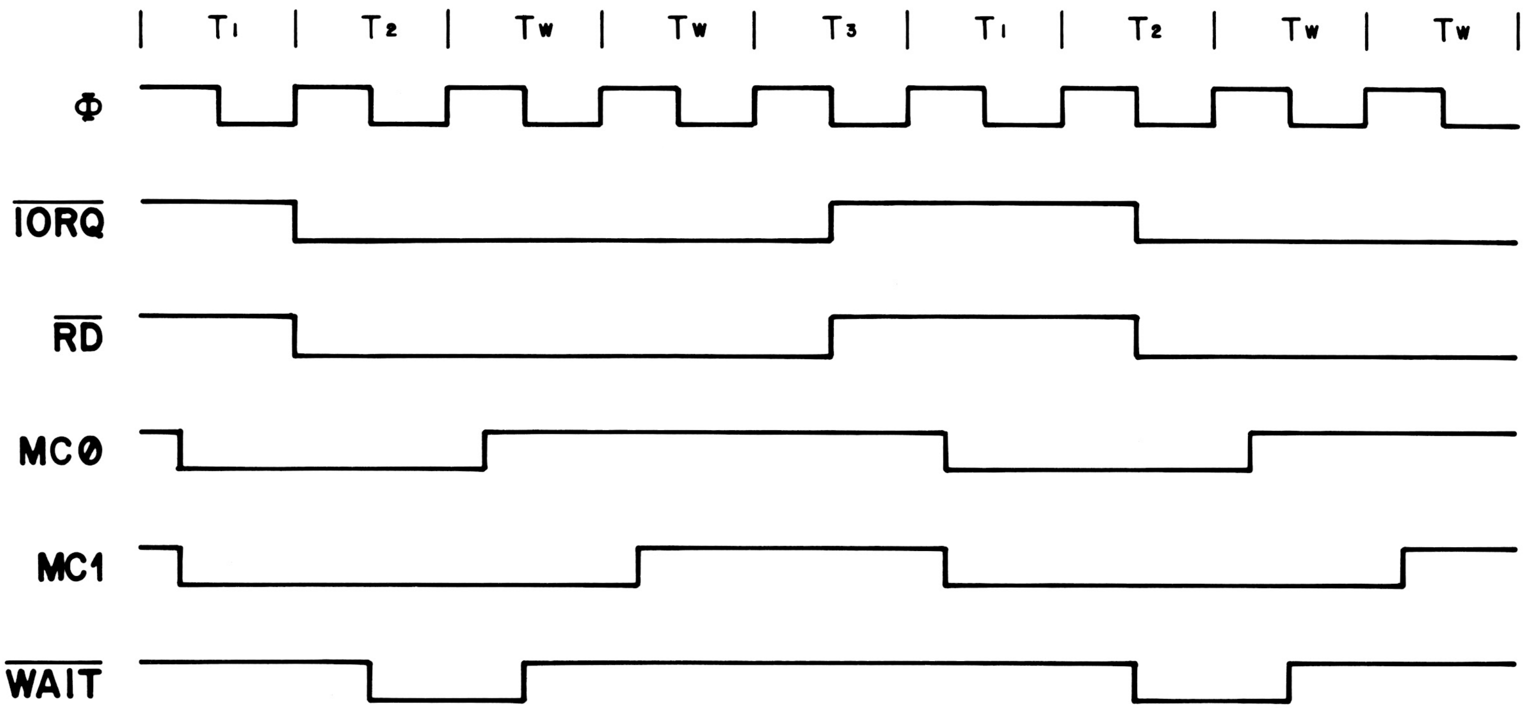
MEMORY READ WITHOUT EXTRA WAIT STATE



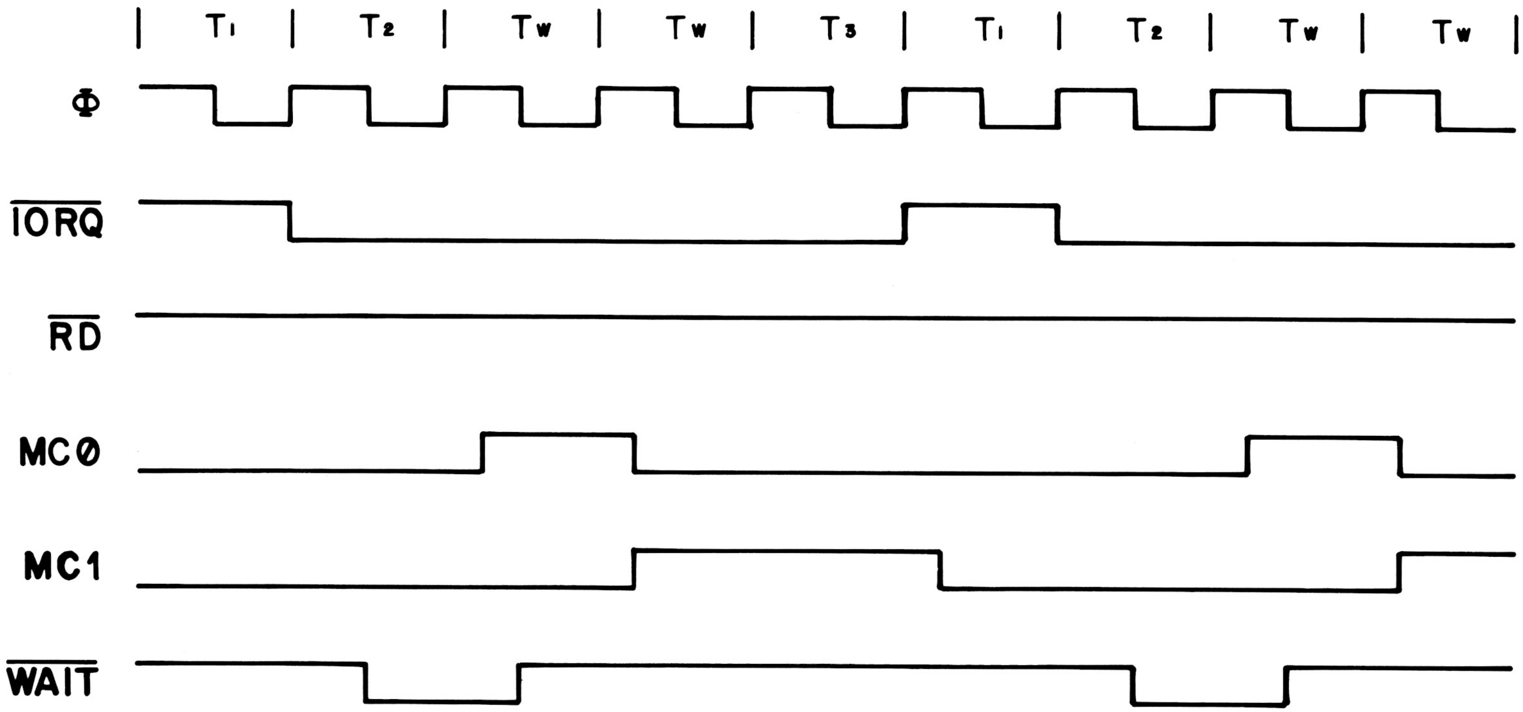
MEMORY READ WITH VIDEO WAIT STATE



I/O READ FROM PORT 10H-17H



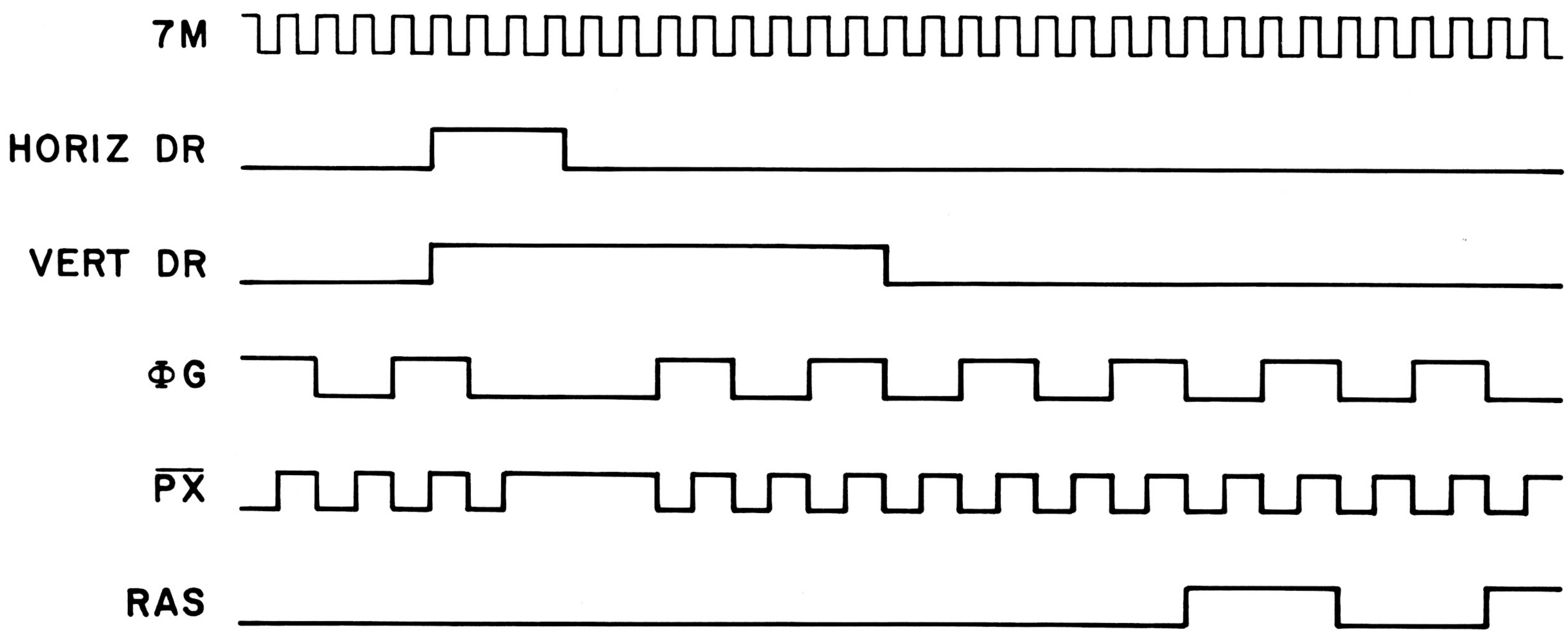
I/O READ FROM OTHER THAN PORT 1ØH-17H


T1
T2
Tw
Tw
T3
T1
T2
Tw
Tw
Φ
$\overline{IORQ}$
$\overline{RD}$
MCØ
MC1
$\overline{WAIT}$

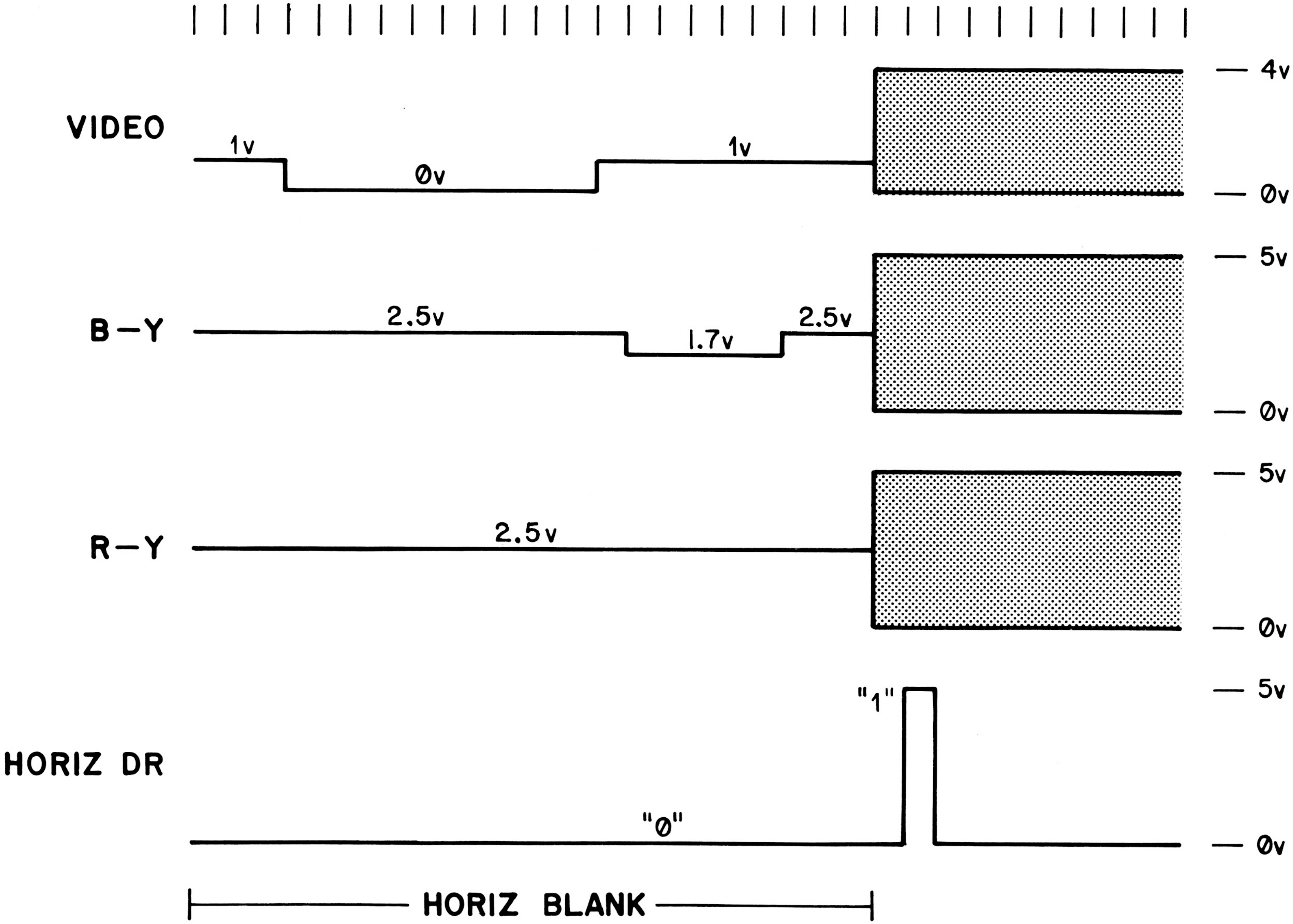
I/O WRITE

VIDEO TIMING

The frequency of $\overline{PX}$ is half that of 7M and the Ø is one-fourth 7M. There are 455 cycles of 7M per horizontal line and 113 3/4 Φ cycles per line. Because of the extra 3/4 cycle Ø must be resynchronized at the beginning of each line. This is done by stalling Ø for 3 cycles of 7M. $\overline{PX}$ is also stalled for the same amount of time. The timing relationship is shown below. The diagram also shows the relationship of VERT DR to HORIZ DR. The two RAS pulses shown are the first two video RAS signals of a line, each line contains forty.



RELATIONSHIP BETWEEN 7M, HORIZ DR, VERT DR, ΦG, $\overline{PX}$ AND RAS

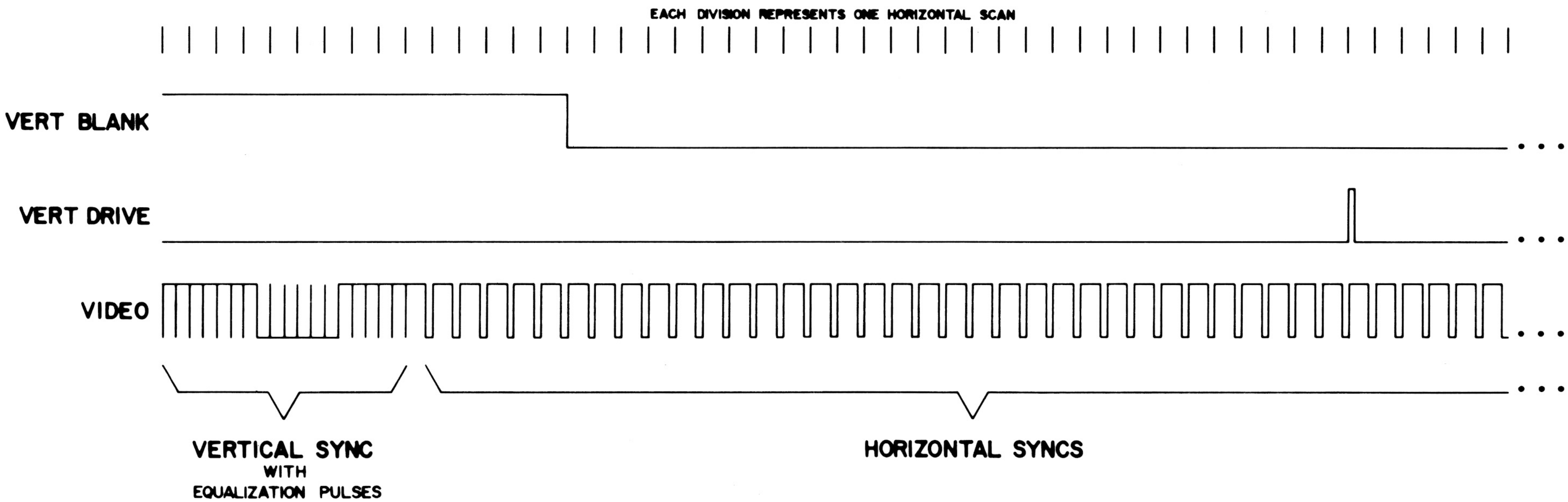


RELATIONSHIP BETWEEN HORIZ DR, HORIZ BLANK, HORIZ SYNC AND COLOR BURST

EACH HORIZONTAL DIVISION IS EQUAL TO 3½ CYCLES OF 7M

THE PATTERN REPEATS EVERY 455 CYCLES OF 7M

SHADED AREA VOLTAGE DETERMINED BY THE DATA IN RAM



RELATIONSHIP BETWEEN VERTICAL SYNC, VERTICAL BLANK AND VERTICAL DRIVE
EACH HORIZONTAL DIVISION REPRESENTS ONE HORIZONTAL SCAN

1/14/77	N/C
1/27/77	A
3/25/77	B
7/6/77	C

ELECTRICAL SPECIFICATION FOR MIDWAY CUSTOM CIRCUITS

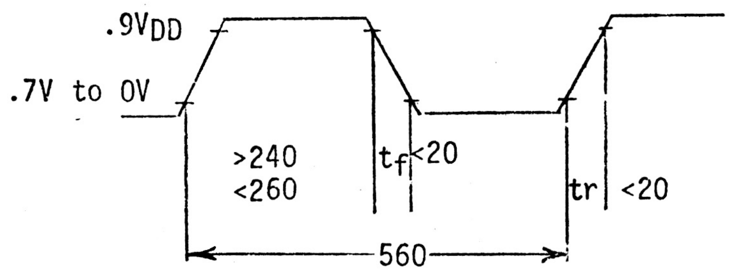
I. GENERAL SYSTEM PARAMETERS

I. A. Power Supplies

1. VDD=+5.0V $\pm$5%
2. VGG=+10.0V $\pm$5%
3. VSS=0.0V

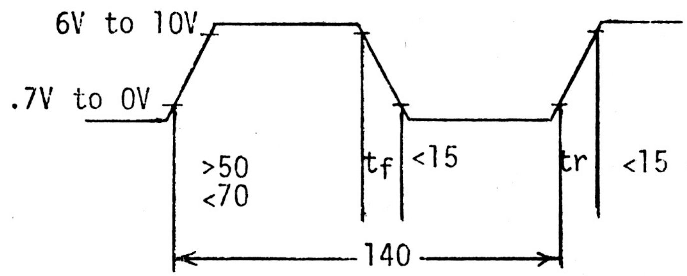
I. B. Timing Signals

1. Ø & $\overline{Ø}$; Period = 560nsec, High time* 240nsec to 260nsec.
   Ø and $\overline{Ø}$ have zero level crossover +1 volt -0 volts
   t_r, t_f* less than 20nsec



(Times are in nsec)

2. 7M & $\overline{7M}$; Period = 140nsec, High time$^+$ 50nsec to 70nsec
   7M & 7M have zero level crossover +1 volt -0 volt
   t_r, $t_f$$^+$ less than 15nsec



(Times are in nsec)

Dead time $\leq$ 5nsec
Max C Load = 20pf

+Note
1) High time is time clock at $\geq$.6V.
2) Rise time from zero level to one level.

I. B. (Continued)

*Note:

1. High time is time between 50% points.

2. Clock signals are generated by low power Shottky Logic (series 74LS). Full level swing on clock signals to be achieved through external resistor to V_{DD}. Zero level .7V to 0V.

3. Rise time from zero level to $.9V_{DD}$.

I. C. Z80 Data Bus (MUXDØ-MUXD7)

1. Z80 Data Bus interface requires a three-state output/input buffer. The three states are defined below.

2. Logic 0: .5V + noise generated by chip, noise for address chip is .15V @ -430μA

3. Logic 1: 2.7V @ +70μA

4. High Impedance: Leakage at either logic 0 or 1 to be less than 5μA.

5. Transient Response: Transition from High Impedance to 0 or 1 will be complete within 442nsec of the 90% point of $\overline{Ø}$ of the last wait state of input cycle or 442nsec of the 90% point of Ø of the second wait state of the interrupt acknowledge cycle. The maximum load will be 80pf. This includes 14pfd for two custom chips.

6. Exception: The path through the Data chip connecting the RAM bus with the Z80 bus shall introduce a maximum of 160nsec of delay.

7. The low address byte will be valid on the Z80 Data Bus at least 62nsec before $\overline{Ø}$. The high address byte will be valid at least 79nsec before $\overline{Ø}$. The data byte will be valid 55nsec before $\overline{Ø}$.

I. D. RAM Data Bus (MD0-MD7) - Home Game

1. The RAM Data Bus will require three state logic buffers.
2. Logic 0: .5V @ -25μA
3. Logic 1: 2.7V @ +25μA
4. High Impedance: 5μA maximum leakage at either logic 0 or 1.
5. Transient Response: The outputs shall transition from High Impedance to 0 or 1 within 120nsec of 7M. The outputs shall transition from 1 or 0 to high impedance within 20nsec of 7M. Maximum load will be 20pf.

I. E. RAM Data Bus (MD0-MD7) - Commercial Game

1. The RAM Data Bus will require three state logic buffers.
2. Logic 0: .5V @ -200μA
3. Logic 1: 2.7V @ +25μA
4. High Impedance: 5μA maximum leakage of either logic 0 or 1.
5. Transient Response: The output shall transition from High Impedance to 0 or 1 within 120nsec of 7M. The output shall transition from 1 or 0 to High Impedance within 2nsec of 7M. Maximum load will be 10pf.

I. F. Ambient operating temperature $\geq 0^{o}C$, $\leq 55^{o}C$.

I. G. Storage temperature $\geq -65^{o}C$, $\leq 150^{o}C$.

I. H. Packing 40 pin plastic.

II. CUSTOM CIRCUIT SPECIFICATION

This specification defines the terminal characteristics for each of the custom circuits. These specifications shall take precedence in case of conflict. All Ø references refer to the Ø and $\overline{Ø}$ inputs to the address and I/O chip.

II. A. Data Chip

1. Input Pin List

	VO (V)	V1 (V)	td (Low)[1] (nsec)	td (High)[1] (nsec)	Ref.
$\overline{MREQ}$	.5	2.45	132	6	7M
$\overline{RD}$	.5	2.45	12	6	7M
$\overline{IORQ}$	.5	2.45	112	126	7M
7M	See Section I.B.				
$\overline{7M}$	"	"			
$\overline{WRCTL}$	.5	3.1	82	82	7M
$\overline{M1}$	.5	2.45	12	82	7M
LTCHDO	.5	3.1	120	120	7M
Serial 0	.5	2.45	30	30	7M
Serial 1	.5	2.45	30	30	7M

2. Power Supplies

See Section I. A.

3. Bus Connections

MXD0	See Z80 Data Bus Spec. Section	I.C.
MXD1	"	"
MXD2	"	"
MXD3	"	"
MXD4	"	"
MXD5	"	"
MXD6	"	"
MXD7	"	"
MD0	See RAM Data Bus Spec Section	I.D.
MD1	"	"
MD2	"	"
MD3	"	"
MD4	"	"
MD5	"	"
MD6	"	"
MD7	"	"

4. Outputs

	VO (V)	IO (μA)	V1 (V)	I1 (μA)	CAP (pf)	t_p (nsec)	Ref.
VIDEO*	*				10	100	7M
R-Y*	*				10	600	
B-Y*	*				10	600	
HORIZ DR	Note 4	400	2.7	20	20	20	7M
VERT DR	Note 4	400	2.7	20	20	20	7M
2.5V[6]	--	--	--	--	--	DC	
Ø	Note 4	400	2.7	20	10	100	7M
$\overline{\text{PXCLK}}$	Note 4	400	2.7	20	10	100	7M
MC0	Note 4	400	2.7	20	10	120	7M
MC1	Note 4	400	2.7	20	10	120	7M
$\overline{\text{DATEN}}$	Note 4	400	2.7	20	10	90	7M

*Video, R-Y, B-Y are analog outputs at 140nsec rate. Video, must switch from 10% to 90% of blank to white in 140nsec. R-Y and B-Y transitions not to exceed .6μsec.

1 t_d (Low) and t_d (High) is maximum time in nsec except where a minimum is shown.
2 For $\overline{\text{IORQ}}$ Ref. to $\overline{Ø}$ t_d (Low)=132nsec t_d (High)=6nsec.
3 Serial 0 and Serial 1 will operate at 7MHz.
4 .5V + noise generated by chip.
5 Tap on both resistor chains for a capacitor. Will become test input with voltage applied > 8V.
6 The Z80 Ø is generated by this signal with a clock driver which introduces a delay of <20nsec.

II. B. I/O Chip

1. Input Pin List

Input Pin List	VO	V1	Ref	t_d (High) (nsec)	t_d (Low) (nsec)
Reset	.5	2.45			
MONOS	Note 1				
$\overline{RD}$	.5	2.45	Ø or $\overline{Ø}$	166	172 Ø or $\overline{Ø}$
$\overline{IORQ}$	.5	2.45	Ø^6	146 $\overline{Ø}$	132 Ø
Ø	See Section I.B.				
$\overline{Ø}$	"	"	"		
SIØ	.5	3.3			Note 3
SI1	.5	3.3			Note 3
SI2	.5	3.3			Note 3
SI3	.5	3.3			Note 3
SI4	.5	3.3			Note 3
SI5	.5	3.3			Note 3
SI6	.5	3.3			Note 3
SI7	.5	3.3			Note 3
TEST	.5	5.0			DC

2. Power Supplies

See Section I.A.

3. Bus Connections

MUXD0	See Z80 Data Bus Spec Section I.C.
MUXD1	" "
MUXD2	" "
MUXD3	" "
MUXD4	" "
MUXD5	" "
MUXD6	" "
MUXD7	" "

4. Outputs

Outputs		VO (V)	IO (µA)	V1 (V)	I1 (µA)
Audio	Note 4	Fmax - 20KHz			
Discharge	Note 5	.5V	4V		
SOØ	Note 3	Note 7	200	4V	1650
SO1	Note 3	Note 7	200	4V	1650
SO2	Note 3	Note 7	200	4V	1650
SO3	Note 3	Note 7	200	4V	1650
SO4	Note 3	Note 7	200	4V	1650
SO5	Note 3	Note 7	200	4V	1650
SO6	Note 3	Note 7	200	4V	1650
SO7	Note 3	Note 7	200	4V	1650
POT Ø	Note 2		5	V_{DD}-.5	50
POT 1	Note 2		5	V_{DD}-.5	50
POT 2	Note 2		5	V_{DD}-.5	50
POT 3	Note 2		5	V_{DD}-.5	50

Note 1 MONOS triggers at 2.1 volts $\pm 2\%$ $\pm$ noise voltage when the supply is 5.25V.

Note 2 Open source-Voltage measured with 0.2ma.

Note 3 Time from load of address into microcycle register to date valid on MUX data bus from SI inputs (data path through address decoder, out on SO outputs, through closed switch and isolation diode, into SI input to MUX Data Bus) shall be 2μsec max. Drop of isolation diode will be 0.7V max. SO must drive 2kΩ in the high level. Max C load of SO shall be 300 pf. SI input shall have kill device enabled by $\overline{\text{INPUT}}$.

Note 4 Audio voltage oscillates between 0V and one of the following voltages; .33, .67, 1.00, 1.33, 1.67, 2.00, 2.33, 2.67, 3.00, 3.33, 3.67, 4.00, 4.33, 4.67 and 5.00. These voltages should be $\pm 6\%$. The load shall be 1000pf and 100kΩ.

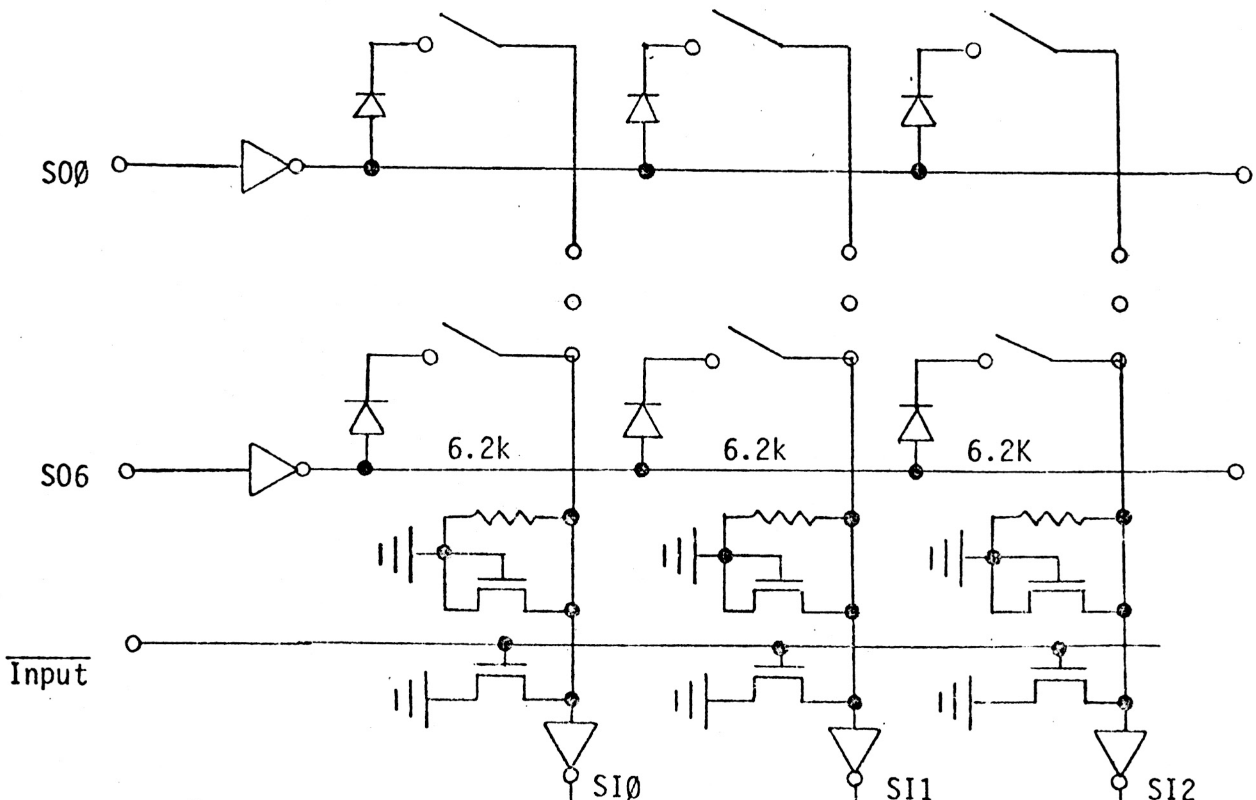
Note 5 Discharge is open drain to V_{SS}. Discharges .01μfd capacitor to .2V in 144μsec.

Note 6 For $\overline{\text{IOREQ}}$ Ref. to $\overline{\emptyset}$ t_d (Low)=152nsec t_d (High)=166nsec.

Note 7 .5V + noise generated by I/O chip.

Miscellaneous Timing

Time for MO Adder - 2∅ max



No more than three switches on each SO are closed at one time.

II. C. Address Chip

1. Input Pin List

	VO (V)	V1 (V)	t_{pd} (Low) (nsec)	t_{pd} (High) (nsec)	REF
$\overline{\text{RFSH}}$	.5	2.45	222 Ø	216	Ø
$\overline{\text{MREQ}}$	.5	2.45	152 Ø	166	Ø or $\overline{Ø}$
$\overline{\text{RD}}$	.5	2.45	172 Ø or $\overline{Ø}$	166	Ø or $\overline{Ø}$
$\overline{\text{MI}}$	.5	2.45	176 Ø	242	Ø
A12[1]	.5	2.45			Ø
A13[1]	.5	2.45			Ø
A14[1]	.5	2.45			Ø
A15[1]	.5	2.45			Ø
$\overline{\text{IORQ}}$	.5	2.45	132 Ø	146	$\overline{Ø}$[2]
$\overline{\text{LIGHT PEN}}$	.5	2.45	Asyn		
$\overline{\text{TEST}}$	.5	5.0	DC		
HORIZ. DR.	.5	2.45	Note 3		$\overline{Ø}$
VERT. DR.	.5	2.45	Note 4		Ø
Ø	See Section I.B.				
$\overline{Ø}$	"	"	"		

2. Power Supplies

See Section I.A.

3. Bus Connections

MXD0	See Z80 Data Bus Spec Section I.E.
MXD1	" "
MXD2	" "
MXD3	" "
MXD4	" "
MXD5	" "
MXD6	" "
MXD7	" "

4. Outputs

Outputs	VO (V)	IO (μA)	V1 (V)	I1 (μA)	CAP (pf)	t_{pd}(Low) (nsec)	t_{pd}(High) (nsec)	REF
$\overline{\text{LATCHDO}}$	Note 7	Note 6	3.1	Note 6	10	280	140	$\overline{Ø}$[5]
$\overline{\text{WAIT}}$	" "	400	2.4	20	25	490	490	$\overline{Ø}$
$\overline{\text{MA0-MA5}}$	" "	400	2.4	20	20	242	240	$\overline{Ø}$ or Ø
$\overline{\text{INT}}$	" "	400	2.4	20	25	490	572	$\overline{Ø}$
$\overline{\text{RAS0-RAS3}}$	" "	400	2.4	20	20	382	382	$\overline{Ø}$
$\overline{\text{WRCTL}}$	" "	Note 6	3.1	Note 6	10	382	382	$\overline{Ø}$

1. Time from High Impedance to 1 or 0 is 200nsec. (from $Ø_1$ of T_1)
2. For $\overline{\text{IORQ}}$ Ref to $\overline{Ø}$ t_d (Low)=152nsec t_d (High)=166nsec. Ø_
3. Horizontal Drive time from low to high is 40nsec after $\overline{Ø}$.
   Time from high to low is 100nsec before rising edge of Ø.
4. Vertical Drive will transition from low to high 40nsec after falling edge of Ø. Its width will be 2.1 μsec max. 1.54μsec min. It will go from high to low 100nsec before falling edge of Ø.
5. Reference t_{pd} (High) is Ø.
6. MOS to MOS signal.
7. .5V + noise generated by Address Chip (.15V) = .65V

III. I/O MODE DECODE

I/O Parts

HEX	Out	Input
0	Color Ø Right	
1	" 1 "	
2	" 2 "	
3	" 3 "	
4	" 0 Left	
5	" 1 "	
6	" 2 "	
7	" 3 "	
8	Consumer/Commercial	Intercept Feedback
9	Horiz Color Bndry	
A	Vertical Blank	
B	Color Block TX	
C	Magic Reg	
D	Interrupt Feedback	
E	Interrupt Mode	Vertical Addr Feedback
F	Interrupt Line	Horizontal Addr Feedback
10	Tone Master OSC	SW Bank 0
11	Tone A	1
12	" B	2
13	" C	3
14	Tremello	4
15	Tone C Volume	5
16	Tone A,B Volume	6
17	Noise Volume	7
18	Sound Block TX	
19		
1A		
1B		
1C		POT 0
1D		" 1
1E		" 2
1F		" 3
20		
21		
22		
23		
24		
.		
.		
2F		

Software and Hardware for the Bally Arcade - A Technical Description

A Dave Nutting Associates Design

Bally Arcade

8K ROM Source Listing

```
ADDR OBJECT        LABEL   OPCD OPERAND       COMMENT

                     ; ***************************
                     ; * HOME VIDEO GAME EQUATES *
                     ; ***************************
                     ;
                     ; ASSEMBLY CONTROL
                     ;
>0001              XPNDON   EQU  1              ; ** SET TO 1 WHEN HARDWARE EXP
>0001              NWHDWR   EQU  1              ; ** SET TO 1 WHEN NEW HARDWARE
                     ;
                     ; GENERAL GOODIES
>4000              NORMEM   EQU  4000H
>2000              FIRSTC   EQU  2000H          ; FIRST ADDRESS IN CASSETTE
>0000              SCREEN   EQU  0
>0028              BYTEPL   EQU  40             ; BYTES PER LINE
>00A0              BITSPL   EQU  160            ; BITS PER LINE
                   ; STUFF IN SYSTEM DOPE VECTOR
>0200              STIMER   EQU  200H           ; SECONDS AND GAME TIME,MUSIC
>0203              CTIMER   EQU  203H           ; CUSTOM TIMERS
>0206              FNTSYS   EQU  206H           ; SYSTEM FONT DESCRIPTOR
>020D              FNTSML   EQU  20DH           ; SMALL FONT DESCRIPTOR
>0214              ALKEYS   EQU  214H           ; KEYMASK OF ALL KEYS
>0218              MENUST   EQU  218H           ; HEAD OF ONBOARD MENU
>021E              MXSCR    EQU  21EH           ; ADDRESS OF 'MAX SCORE'
>0228              NOPLAY   EQU  228H           ; ADDRESS OF '# OF PLAYERS'
>0235              NOGAME   EQU  235H           ; ADDRESS OF '# OF GAMES'
                     ; BITS IN PROCESSOR FLAG BYTE
>0007              PSWSGN   EQU  7              ; SIGN BIT
>0006              PSWZRO   EQU  6              ; ZERO BIT
>0002              PSWPV    EQU  2              ; PARITY        OVERFLOW
>0000              PSWCY    EQU  0              ; CARRY
                     ; BITS IN GAME STATUS BYTE
>0000              GSBTIM   EQU  0
>0001              GSBSCR   EQU  1
>0007              GSBEND   EQU  7
                     ; STANDARD VECTOR DISPLACEMENTS AND BITS
>0000              VBMR     EQU  0              ; MAGIC REGISTER
>0001              VBSTAT   EQU  1              ; STATUS
>0002              VBTIMB   EQU  2              ; TIME BASE
>0003              VBDXL    EQU  3              ; DELTA X LO
>0004              VBDXH    EQU  4              ; DELTA X HI
>0005              VBXL     EQU  5              ; X COORD LO
>0006              VBXH     EQU  6              ; X COORD HI
>0007              VBXCHK   EQU  7              ; X CHECK FLAGS
>0008              VBDYL    EQU  8              ; DELTA Y LO
>0009              VBDYH    EQU  09H            ; DELTA Y HI
>000A              VBYL     EQU  0AH            ; Y COORD LO
>000B              VBYH     EQU  0BH            ; Y COORD HI
>000C              VBYCHK   EQU  0CH            ; Y CHECK FLAGS
>000D              VBOAL    EQU  0DH            ; OLD ADDRESS L.O.
>000E              VBOAH    EQU  0EH            ; OLD ADDRESS H.O.
                      ; DISPLACEMENTS FROM START OF COORDINATE AREA
>0000              VBDCL    EQU  0              ; LO DELTA
>0001              VBDCH    EQU  1              ; HI DELTA
>0002              VBCL     EQU  2              ; LO COORD
>0003              VBCH     EQU  3              ; HI COORD
>0004              VBCCHK   EQU  4              ; CHECK BITS
```

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ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

                86    ; BITS IN STATUS BYTE
>0007           87  VBSACT  EQU  7              ; VECTOR ACTIVE STATUS
>0006           88  VBBLNK  EQU  6              ; BLANK STATUS
                89    ; BITS IN CHECK BIT MASK
>0000           90  VBCLMT  EQU  0              ; DO LIMIT CHECKING
>0001           91  VBCREV  EQU  1              ; REVERSE DELTA ON LIMIT ATTAIN
>0003           92  VBCLAT  EQU  3              ; COORDINATE IS AT LIMIT
                93   ; FONT TABLE DISPLACEMENTS FOR NEW CHARACTER DISPLAY ROU
>0000           94  FTBASE  EQU  0              ; BASE CHARACTER
>0001           95  FTFSX   EQU  1              ; X FRAME SIZE
>0002           96  FTFSY   EQU  2              ; Y FRAME SIZE
>0003           97  FTBYTE  EQU  3              ; X SIZE OF CHAR IN BYTES
>0004           98  FTYSIZ  EQU  4              ; Y SIZE IN BITS
>0005           99  FTPTL   EQU  5              ; PATTERN TABLE ADDRESS LO
>0006          100  FTPTH   EQU  6              ; PATTERN TABLE ADDRESS HI
               101    ; BITS FOR MAGIC REGISTER       WRITE OPTION BYTE
>0006          102  MRFLOP  EQU  6              ; WRITE WITH FLOP
>0005          103  MRXOR   EQU  5              ; WRITE WITH EXCLUSIVE OR
>0004          104  MROR    EQU  4              ; WRITE WITH OR
>0003          105  MRXPND  EQU  3              ; WRITE WITH EXPAND
>0002          106  MRROT   EQU  2              ; WRITE WITH ROTATE
>0003          107  MRSHFT  EQU  03H            ; MASK OF SHIFT AMOUNT
               108    ; BITS OF CONTROL HANDLE INPUT PORT
>0004          109  CHTRIG  EQU  4              ; TRIGGER
>0003          110  CHRIGH  EQU  3              ; JOYSTICK RIGHT
>0002          111  CHLEFT  EQU  2              ; JOYSTICK LEFT
>0001          112  CHDOWN  EQU  1              ; DOWN
>0000          113  CHUP    EQU  0              ; UP
               114    ; CONTEXT BLOCK REGISTER DISPLACEMENTS
>0000          115  CBIYL   EQU  0              ; IY
>0001          116  CBIYH   EQU  1
>0002          117  CBIXL   EQU  2              ; IX
>0003          118  CBIXH   EQU  3
>0004          119  CBE     EQU  4              ; DE
>0005          120  CBD     EQU  5
>0006          121  CBC     EQU  6              ; BC
>0007          122  CBB     EQU  7
>0008          123  CBFLAG  EQU  8              ; AF
>0009          124  CBA     EQU  9
>000A          125  CBL     EQU  0AH            ; HL
>000B          126  CBH     EQU  0BH
               127  ; SENTRY RETURN CODE EQUATES:
>0000          128  SNUL    EQU  0              ; NOTHING HAPPENED
>0001          129  SCT0    EQU  1              ; COUNTER-TIMER 1 THRU 8
>0002          130  SCT1    EQU  2
>0003          131  SCT2    EQU  3
>0004          132  SCT3    EQU  4
>0005          133  SCT4    EQU  5
>0006          134  SCT5    EQU  6
>0007          135  SCT6    EQU  7
>0008          136  SCT7    EQU  8
>0009          137  SF0     EQU  9              ; FLAG BIT 0
>000A          138  SF1     EQU  0AH
>000B          139  SF2     EQU  0BH
>000C          140  SF3     EQU  0CH
>000D          141  SF4     EQU  0DH
>000E          142  SF5     EQU  0EH
```

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ADDR OBJECT   STMT  LABEL   OPCD OPERAND       COMMENT

>000F          143  SF6     EQU  0FH
>0010          144  SF7     EQU  10H
>0011          145  SSEC    EQU  11H           ; SECONDS TIMER HAS COUNTED DOW
>0013          146  SKYD    EQU  13H           ; KEY IS DOWN
>0012          147  SKYU    EQU  12H           ; YES IS UP
>001C          148  SP0     EQU  1CH           ; POT 0
>001D          149  SP1     EQU  1DH           ; POT 1
>001E          150  SP2     EQU  1EH           ; POT 2
>001F          151  SP3     EQU  1FH           ; POT 3
>0014          152  ST0     EQU  14H           ; TRIGGER 0
>0015          153  SJ0     EQU  15H           ; JOYSTICK 0
>0016          154  ST1     EQU  16H           ; SIMILARLY FOR 1-3
>0017          155  SJ1     EQU  17H
>0018          156  ST2     EQU  18H
>0019          157  SJ2     EQU  19H
>001A          158  ST3     EQU  1AH
>001B          159  SJ3     EQU  1BH
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

                161    ; ********************************
                162    ; * HOME VIDEO GAME PORT EQUATES *
                163    ; ********************************
                164    ; OUTPUT PORTS FOR VIRTUAL COLOR
>0000           165  COLOR    EQU  0              ; COLOR 0 RIGHT
>0001           166  COL1R    EQU  1              ; COLOR 1 RIGHT
>0002           167  COL2R    EQU  2              ; COLOR 2 RIGHT
>0003           168  COL3R    EQU  3              ; COLOR 3 RIGHT
>0004           169  COLOL    EQU  4              ; COLOR 0 LEFT
>0005           170  COL1L    EQU  5              ; COLOR 1 LEFT
>0006           171  COL2L    EQU  6              ; COLOR 2 LEFT
>0007           172  COL3L    EQU  7              ; COLOR 3 LEFT
>000B           173  COLBX    EQU  0BH            ; COLOR BLOCK OUTPUT PORT
>0009           174  HORCB    EQU  9              ; HORIZONTAL COLOR BOUNDARY
>000A           175  VERBL    EQU  0AH            ; VERTICAL BLANKING LINE
                176    ; OUTPUT PORTS FOR MUSIC AND SOUNDS
>0010           177  TONMO    EQU  10H            ; TONE MASTER OSCILLATOR
>0011           178  TONEA    EQU  11H            ; TONE A OSC.
>0012           179  TONEB    EQU  12H            ; TONE B OSC.
>0013           180  TONEC    EQU  13H            ; TONE C OSC.
>0014           181  VIBRA    EQU  14H            ; VIBRATO
>0016           182  VOLAB    EQU  16H            ; TONES A,B VOLUME
>0015           183  VOLC     EQU  15H            ; TONE C VOLUME
>0017           184  VOLN     EQU  17H            ; NOISE VOLUME
>0018           185  SNDBX    EQU  18H            ; SOUND BLOCK OUTPUT PORT
                186    ; INTERRUPT AND CONTROL OUTPUT PORTS
>000D           187  INFBK    EQU  0DH            ; INTERRUPT FEEDBACK
>000E           188  INMOD    EQU  0EH            ; INTERRUPT MODE
>000F           189  INLIN    EQU  0FH            ; INTERRUPT LINE
>0008           190  CONCM    EQU  8              ; CONSUMER       COMMERCIAL
>000C           191  MAGIC    EQU  0CH            ; MAGIC REGISTER
>0019           192  XPAND    EQU  19H            ; EXPANDER PIXEL DEFINITION FOR
                193    ; INTERRUPT AND INTERCEPT INPUT PORTS
>0008           194  INTST    EQU  8              ; INTERCEPT STATUS
>000E           195  VERAF    EQU  0EH            ; VERTICAL ADDRESS FEEDBACK
>000F           196  HORAF    EQU  0FH            ; HORIZONTAL ADDRESS FEEDBACK
                197    ; HAND CONTROLS INPUT PORTS
>0010           198  SW0      EQU  10H            ; PLAYER 0 HAND CONTROL
>0011           199  SW1      EQU  11H            ; PLAYER 1 HAND CONTROL
>0012           200  SW2      EQU  12H            ; PLAYER 2 HAND CONTROL
>0013           201  SW3      EQU  13H            ; PLAYER 3 HAND CONTROL
>001C           202  POT0     EQU  1CH            ; PLAYER 0 POT
>001D           203  POT1     EQU  1DH            ; PLAYER 1 POT
>001E           204  POT2     EQU  1EH            ; PLAYER 2 POT
>001F           205  POT3     EQU  1FH            ; PLAYER 3 POT
                206    ; KEYBOARD INPUT PORTS
>0014           207  KEY0     EQU  14H            ; KEYBOARD COLUMN 0
>0015           208  KEY1     EQU  15H            ; KEYBOARD COLUMN 1
>0016           209  KEY2     EQU  16H            ; KEYBOARD COLUMN 2
>0017           210  KEY3     EQU  17H            ; KEYBOARD COLUMN 3
```

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ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

                212   ; ****************************************
                213   ; * HOME VIDEO GAME SYSTEM CALL INDEXES *
                214   ; ****************************************
                215   ; USER PROGRAM INTERFACE
>0000           216  UPISTR  EQU  0
>0000           217  INTPC   EQU  UPISTR       ; INTERPRET WITH CONTEXT CREATE
>0002           218  XINTC   EQU  INTPC+2      ; EXIT INTERPRETER WITH CONTEXT
>0004           219  RCALL   EQU  XINTC+2      ; CALL ASM LANGUAGE SUBROUTINE
>0006           220  MCALL   EQU  RCALL+2      ; CALL INTERPRETER SUBROUTINE
>0008           221  MRET    EQU  MCALL+2      ; RETURN FROM INTERPRETER SUBRO
>000A           222  MJUMP   EQU  MRET+2       ; MACRO JUMP
>000C           223  SUCK    EQU  MJUMP+2      ; SUCK INLINE ARGS INTO CB
                224   ; SCHEDULER ROUTINES
>000C           225  SCHEDR  EQU  SUCK
>000E           226  ACTINT  EQU  SCHEDR+2     ; SET SUB TIMER
>0010           227  DECCTS  EQU  ACTINT+2     ; DEC CT'S UNDER MASK
                228   ; MUSIC AND SOUNDS
>0012           229  MUZAK   EQU  DECCTS+2
>0012           230  BMUSIC  EQU  MUZAK        ; BEGIN PLAYING MUSIC
>0014           231  EMUSIC  EQU  BMUSIC+2     ; STOP PLAYING MUSIC
                232   ; SCREEN HANDLER ROUTINES
>0016           233  SCRSTR  EQU  EMUSIC+2
>0016           234  SETOUT  EQU  SCRSTR       ; SET SCREEN SIZE
>0018           235  COLSET  EQU  SETOUT+2     ; SET COLORS
>001A           236  FILL    EQU  COLSET+2     ; FILL MEMORY WITH CONSTANT DAT
>001C           237  RECTAN  EQU  FILL+2       ; PAINT RECTANGLE
>001E           238  VWRITR  EQU  RECTAN+2     ; WRITE RELATIVE FROM VECTOR
>0020           239  WRITR   EQU  VWRITR+2     ; WRITE RELATIVE
>0022           240  WRITP   EQU  WRITR+2      ; WRITE WITH PATTERN SIZE LOOKU
>0024           241  WRIT    EQU  WRITP+2      ; WRITE WITH SIZES PROVIDED
>0026           242  WRITA   EQU  WRIT+2       ; WRITE ABSOLUTE
>0028           243  VBLANK  EQU  WRITA+2      ; BLANK AREA FROM VECTOR
>002A           244  BLANK   EQU  VBLANK+2     ; BLANK AREA
>002C           245  SAVE    EQU  BLANK+2      ; SAVE AREA
>002E           246  RESTOR  EQU  SAVE+2       ; RESTORE AREA
>0030           247  SCROLL  EQU  RESTOR+2     ; SCROLL AREA OF SCREEN
                248   ;
>0032           249  CHRDIS  EQU  SCROLL+2     ; NEW DISPLAY CHARACTER
>0034           250  STRDIS  EQU  CHRDIS+2     ; NEW DISPLAY STRING
>0036           251  DISNUM  EQU  STRDIS+2     ; DISPLAY NUMBER
                252   ;
>0038           253  RELABS  EQU  DISNUM+2     ; RELATIVE TO ABSOLUTE CONVERSI
>003A           254  RELAB1  EQU  RELABS+2     ; NONMAGIC RELABS
>003C           255  VECTC   EQU  RELAB1+2     ; VECTOR SINGLE COORDINATE
>003E           256  VECT    EQU  VECTC+2      ; VECTOR COORDINATE PAIR
                257   ; HUMAN INTERFACE ROUTINES
>0040           258  HUMANR  EQU  VECT+2
>0040           259  KCTASC  EQU  HUMANR       ; KEY CODE TO ASCII
>0042           260  SENTRY  EQU  KCTASC+2     ; SENSE TRANSITION
>0044           261  DOIT    EQU  SENTRY+2     ; BRANCH TO TRANSITION HANDLER
>0046           262  DOITB   EQU  DOIT+2       ; USE B INSTEAD OF A
>0048           263  PIZBRK  EQU  DOITB+2      ; TAKE A BREAK
>004A           264  MENU    EQU  PIZBRK+2     ; DISPLAY A MENU
>004C           265  GETPAR  EQU  MENU+2       ; GET GAME PARAMETER FROM USER
>004E           266  GETNUM  EQU  GETPAR+2     ; GET NUMBER FROM USER
>0050           267  PAWS    EQU  GETNUM+2     ; PAUSE
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

>0052           268  DISTIM   EQU  PAWS+2        ; DISPLAY TIME
>0054           269  INCSCR   EQU  DISTIM+2      ; INC SCORE
                270   ; MATH ROUTINES
>0056           271  MATH     EQU  INCSCR+2
>0056           272  INDEXN   EQU  MATH          ; INDEX NIBBLE
>0058           273  STOREN   EQU  INDEXN+2
>005A           274  INDEXW   EQU  STOREN+2      ; INDEX WORD
>005C           275  INDEXB   EQU  INDEXW+2      ; INDEX BYTE
>005E           276  MOVE     EQU  INDEXB+2      ; BLOCK TRANSFER
>0060           277  SHIFTU   EQU  MOVE+2        ; SHIFT UP A DIGIT
>0062           278  BCDADD   EQU  SHIFTU+2      ; BCD ADD
>0064           279  BCDSUB   EQU  BCDADD+2      ; BCD SUBTRACT
>0066           280  BCDMUL   EQU  BCDSUB+2      ; BCD MULTIPLY
>0068           281  BCDDIV   EQU  BCDMUL+2      ; BCD DIVIDE
>006A           282  BCDCHS   EQU  BCDDIV+2      ; BCD CHANGE SIGN
>006C           283  BCDNEG   EQU  BCDCHS+2      ; BCD NEGATE
>006E           284  DADD     EQU  BCDNEG+2      ; DECIMAL ADD
>0070           285  DSMG     EQU  DADD+2        ; CONVERT TO SIGN MAGNITUDE
>0072           286  DABS     EQU  DSMG+2        ; DECIMAL ABSOLUTE VALUE
>0074           287  NEGT     EQU  DABS+2        ; NEGATE
>0076           288  RANGED   EQU  NEGT+2        ; RANGED RANDOM NUMBER
>0078           289  QUIT     EQU  RANGED+2      ; QUIT CASSETTE EXECUTION
>007A           290  SETB     EQU  QUIT+2        ; SET BYTE
>007C           291  SETW     EQU  SETB+2        ; SET WORD
>007E           292  MSKTD    EQU  SETW+2        ; MASK TO DELTAS
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

              294     ; **********
              295     ; * MACROS *
              296     ; **********
              297     ; MACROS TO DEFINE PATTERNS
              298   DEF2    MACR #AA,#AB
              299           DEFB #AA
              300           DEFB #AB
              301           ENDM
              302   DEF3    MACR #BA,#BB,#BC
              303           DEFB #BA
              304           DEFB #BB
              305           DEFB #BC
              306           ENDM
              307   DEF4    MACR #CA,#CB,#CC,#CD
              308           DEFB #CA
              309           DEFB #CB
              310           DEFB #CC
              311           DEFB #CD
              312           ENDM
              313   DEF5    MACR #DA,#DB,#DC,#DD,#DE
              314           DEFB #DA
              315           DEFB #DB
              316           DEFB #DC
              317           DEFB #DD
              318           DEFB #DE
              319           ENDM
              320   DEF6    MACR #EA,#EB,#EC,#ED,#EE,#EF
              321           DEFB #EA
              322           DEFB #EB
              323           DEFB #EC
              324           DEFB #ED
              325           DEFB #EE
              326           DEFB #EF
              327           ENDM
              328   DEF8    MACR #GA,#GB,#GC,#GD,#GE,#GF,#GG,#GH
              329           DEFB #GA
              330           DEFB #GB
              331           DEFB #GC
              332           DEFB #GD
              333           DEFB #GE
              334           DEFB #GF
              335           DEFB #GG
              336           DEFB #GH
              337           ENDM
              338     ; MACROS TO COMPUTE CONSTANT SCREEN ADDRESSES
              339   XYRELL  MACR #R,#X,#Y       ;RELATIVE LOAD
              340           LD   #R,.RES.(#Y).SHL.8+(#X)
              341           ENDM
              342    ; MACRO TO GENERATE SYSTEM CALL
              343   SYSTEM  MACR #NUMBA
              344           RST  56
              345           DEFB #NUMBA
              346           IF   #NUMBA.EQ.INTPC
              347   INTP@   DEFL 1
              348           ENDIF
              349           ENDM
```

```
                ; MACRO TO GENERATE SYSTEM CALL WITH SUCK OPTION ON
        SYSSUK  MACR #UMBA
                RST  56
                DEFB #UMBA+1
                IF   #UMBA.EQ.INTPC
        INTP@   DEFL 1
                ENDIF
                ENDM
                ; MACROS TO GENERATE MACRO INSTRUCTION CALLS
                ; FILL SCREEN WITH CONSTANT DATA
        FILL?   MACR #START,#NBYTES,#DATA
                DEFB FILL+1
                DEFW #START
                DEFW #NBYTES
                DEFB #DATA
                ENDM
                ; EXIT INTERPRETER WITH CONTEXT RESTORE
        EXIT    MACR
                DEFB XINTC
        INTP@   DEFL 0
                ENDM
                ;INTERPRET WITH INLINE SUCK
        DO      MACR #CID
                DEFB #CID+1
                ENDM
                ;INTERPRET WITHOUT INLINE SUCK
        DONT    MACR #CID
                DEFB #CID
                ENDM
                ;MACRO CALL FROM DOIT TABLE
>00C0   END     EQU  0C0H
        MC      MACR #A,#B,#E
                DEFB #A+80H
                DEFW #B
                IF   0#E
                DEFB 0#E
                ENDIF
                ENDM
                ;REAL CALL FROM DOIT TABLE
        RC      MACR #A,#B,#E
                DEFB #A+40H
                DEFW #B
                IF   0#E
                DEFB 0#E
                ENDIF
                ENDM
                ;REAL JUMP FROM DOIT TABLE
        JMP     MACR #A,#B,#E
                DEFB #A
                DEFW #B
                IF   0#E
                DEFB 0#E
                ENDIF
                ENDM
                ;DISPLAY A STRING
        TEXT    MACR #A,#B,#C,#D
                DEFB STRDIS+1
```

```
ADDR OBJECT   STMT  LABEL    OPCD OPERAND        COMMENT

                             DEFB #B
                             DEFB #C
                             DEFB #D
                             DEFW #A
                             ENDM



                        ;**************
                        ; MUSIC MACROS
                        ; NOTE DURATION,FREQ(S)
                    NOTE1    MACR #DUR,#N1
                             DEFB #DUR&7FH
                             DEFB #N1
                             ENDM
                    NOTE2    MACR #DUR,#N1,#N2
                             DEFB #DUR&7FH
                             DEFB #N1
                             DEFB #N2
                             ENDM
                    NOTE3    MACR #DUR,#N1,#N2,#N3
                             DEFB #DUR
                             DEFB #N1
                             DEFB #N2
                             DEFB #N3
                             ENDM
                    NOTE4    MACR #DUR,#N1,#N2,#N3,#N4
                             DEFB #DUR
                             DEFB #N1
                             DEFB #N2
                             DEFB #N3
                             DEFB #N4
                             ENDM
                    NOTE5    MACR #DUR,#N1,#N2,#N3,#N4,#N5
                             DEFB #DUR
                             DEFB #N1
                             DEFB #N2
                             DEFB #N3
                             DEFB #N4
                             DEFB #N5
                             ENDM
                    MASTER   MACR #OFFSET
                             DEFB 80H
                             DEFB #OFFSET
                             ENDM
                        ; STUFF OUTPUT PORT#,DATA   OR
                        ; OUTPUT SNDBX,DATA10,D11,...,DATA17
                    OUTPUT   MACR #PORT,#D0,#D1,#D2,#D3,#D4,#D5,#D6,#D7
                             IF   .NOT.(#PORT=18H)
                             DEFB 80H+(#PORT&7FH)
                             DEFB #D0
                             ENDIF
                             IF   #PORT=18H
                             DEFB 88H
                             DEF8 #D7,#D6,#D5,#D4,#D3,#D2,#D1,#D0
```

```
ADDR OBJECT   LABEL   OPCD OPERAND       COMMENT

                              ENDIF
                              ENDM
                        ; SET VOICE BYTE
                        ; THE FORMAT OF THE VOICE BYTE IS
                        ; *I*A*I*B*I*C*V*N*
                        ; WHERE N = LOAD NOISE WITH DATA AT PC AND INC PC
                        ; V = LOAD VIBRATO AND INC PC
                        ; I = INC PC
                        ; A,B,C = LOAD TONE A,B,C WITH DATA AT PC
              VOICES  MACR #MASK
                      DEFB 90H
                      DEFB #MASK
                      ENDM
              ; PUSH NUMBER ONTO STACK
              PUSHN   MACR #NUMB
                      DEFB 0A0H+((#NUMB-1).AND.0FH)
                      ENDM
                        ; SET VOLUMES
              VOLUME  MACR #BA,#MC
                      DEFB 0B0H
                      DEFB #BA
                      DEFB #MC
                      ENDM
              ; CALL RELATIVE 0-15 BEYOND SELF+1
              CREL    MACR #BY
                      DEFB 0D0H+(#BY.AND.0FH)
                      ENDM
              ; DEC STACK TOP AND JNZ
              DSJNZ   MACR #ADD
                      DEFB 0C0H
                      DEFW #ADD
                      ENDM
              ; FLIP LEGATO   STACATO
              LEGSTA  MACR
                      DEFB 0E0H
                      ENDM
              REST    MACR #TIME
                      DEFB 0E1H
                      DEFB #TIME
                      ENDM
              QUIET   MACR
                      DEFB 0F0H
                      ENDM
                        ; *****************
                        ; * MUSIC EQUATES *
                        ; *****************
                        ; NOTE VALUES
>00FD         G0      EQU  253
>00EE         GS0     EQU  238
>00E1         A0      EQU  225
>00D4         AS0     EQU  212
>00C8         B0      EQU  200
>00BD         C1      EQU  189
>00B2         CS1     EQU  178
>00A8         D1      EQU  168
>009F         DS1     EQU  159
>0096         E1      EQU  150
```

```
ADDR OBJECT   STMT  LABEL    OPCD OPERAND       COMMENT

>008D          517  F1       EQU  141
>0085          518  FS1      EQU  133
>007E          519  G1       EQU  126
>0077          520  GS1      EQU  119
>0070          521  A1       EQU  112
>006A          522  AS1      EQU  106
>0064          523  B1       EQU  100
>005E          524  C2       EQU  94
>0059          525  CS2      EQU  89
>0054          526  D2       EQU  84
>004F          527  DS2      EQU  79
>004A          528  E2       EQU  74
>0046          529  F2       EQU  70
>0042          530  FS2      EQU  66
>003E          531  G2       EQU  62
>003B          532  GS2      EQU  59
>0037          533  A2       EQU  55
>0034          534  AS2      EQU  52
>0031          535  B2       EQU  49
>002E          536  C3       EQU  46
>002C          537  CS3      EQU  44
>0029          538  D3       EQU  41
>0027          539  DS3      EQU  39
>0025          540  E3       EQU  37
>0022          541  F3       EQU  34
>0020          542  FS3      EQU  32
>001F          543  G3       EQU  31
>001D          544  GS3      EQU  29
>001B          545  A3       EQU  27
>001A          546  AS3      EQU  26
>0018          547  B3       EQU  24
>0017          548  C4       EQU  23
>0015          549  CS4      EQU  21
>0014          550  D4       EQU  20
>0013          551  DS4      EQU  19
>0012          552  E4       EQU  18
>0011          553  F4       EQU  17
>0010          554  FS4      EQU  16
>000F          555  G4       EQU  15
>000E          556  GS4      EQU  14
>000D          557  A4       EQU  13
>000B          558  C5       EQU  11
>000A          559  CS5      EQU  10
>0009          560  DS5      EQU  9
>0008          561  F5       EQU  8
>0007          562  G5       EQU  7
>0006          563  A5       EQU  6
>0005          564  C6       EQU  5
>0004          565  DS6      EQU  4
>0003          566  G6       EQU  3
>0002          567  C7       EQU  2
>0001          568  G7       EQU  1
>0000          569  G8       EQU  0
               570    ; MASTER OSCILATOR OFFSETS
>00FE          571  OB0      EQU  254
>00F1          572  OC0      EQU  241
>00D6          573  OD1      EQU  214
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND      COMMENT

>00BF          574  OE1     EQU  191
>00B4          575  OF1     EQU  180
>00A0          576  OG1     EQU  160
>008F          577  OA1     EQU  143
>0047          578  OA2     EQU  71
>0023          579  OA3     EQU  35
>0011          580  OA4     EQU  17
>0008          581  OA5     EQU  8
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND      COMMENT

               583    ; **************************
               584    ; * SYSTEM RAM MEMORY CELLS *
               585    ; **************************
>0FFF          586  WASTE   EQU  0FFFH
>0FFF          587  WASTER  EQU  WASTE
               588    ;
               589    ; THE FOLLOWING ORG SHOULD BE SET TO THE VALUE OF
               590    ; THE TAG 'SYSRAM', THIS WILL CAUSE SYSTEM RAM
               591    ; TO RESIDE AT THE HIGHEST POSSIBLE ADDRESS
               592    ;
               593          ORG  4FC8H
 4FC8          594          DEFS 6             ; GOT SOME LEFT STILL
>4FCE          595  BEGRAM  EQU  $
               596    ; USED BY MUSIC PROCESSOR
 4FCE          597  MUZPC:  DEFS 2             ; MUSIC PROGRAM COUNTER
 4FD0          598  MUZSP:  DEFS 2             ; MUSIC STACK POINTER
 4FD2          599  PVOLAB: DEFS 1             ; PRESET VOLUME FOR TONES A AND
 4FD3          600  PVOLMC: DEFS 1             ; PRESET VOLUME FOR MASTER OSC
 4FD4          601  VOICES: DEFS 1             ; MUSIC VOICES
               602    ; COUNTER TIMERS (USED BY DECCTS,ACTINT,CTIMER)
 4FD5          603  CT0:    DEFS 1             ; COUNTER TIMER 0
 4FD6          604  CT1:    DEFS 1             ; 1
 4FD7          605  CT2:    DEFS 1             ; 2
 4FD8          606  CT3:    DEFS 1             ; 3
 4FD9          607  CT4:    DEFS 1             ; 4
 4FDA          608  CT5:    DEFS 1             ; 5
 4FDB          609  CT6:    DEFS 1             ; 6
 4FDC          610  CT7:    DEFS 1             ; 7
               611    ; USED BY SENTRY TO TRACK CONTROLS
 4FDD          612  CNT:    DEFS 1             ;COUNTER UPDATE&NUMBER TRACKING
 4FDE          613  SEMI4S: DEFS 1             ; FLAG BITS
 4FDF          614  OPOT0:  DEFS 1             ; POT 0 TRACKING
 4FE0          615  OPOT1:  DEFS 1             ; POT 1 TRACKING
 4FE1          616  OPOT2:  DEFS 1             ; POT 2 TRACKING
 4FE2          617  OPOT3:  DEFS 1             ; POT 3 TRACKING
 4FE3          618  KEYSEX: DEFS 1             ; KEYBOARD TRACKING BYTE
 4FE4          619  OSW0:   DEFS 1             ; SWITCH 0 TRACKING
 4FE5          620  OSW1:   DEFS 1             ; SWITCH 1 TRACKING
 4FE6          621  OSW2:   DEFS 1             ; SWITCH 2 TRACKING
 4FE7          622  OSW3:   DEFS 1             ; SWITCH 3 TRACKING
 4FE8          623  COLLST: DEFS 2             ; COLOR LIST ADDRESS FOR P.B. A
               624    ; USED BY STIMER
 4FEA          625  DURAT:  DEFS 1             ; NOTE DURATION
 4FEB          626  TMR60:  DEFS 1             ; SIXTIETHS OF SEC
 4FEC          627  TIMOUT: DEFS 1             ; BLAKOUT TIMER
 4FED          628  GTSECS: DEFS 1             ; GAME TIME SECONDS
 4FEE          629  GTMINS: DEFS 1             ; GAME TIME MINUTES
               630    ; USED BY MENU
 4FEF          631  RANSHT: DEFS 4             ; RANDOM NUMBER SHIFT REGISTER
 4FF3          632  NUMPLY: DEFS 1             ; NUMBER OF PLAYERS
 4FF4          633  ENDSCR: DEFS 3             ; SCORE TO 'PLAY TO'
 4FF7          634  MRLOCK: DEFS 1             ; MAGIC REGISTER LOCK OUT FLAG
 4FF8          635  GAMSTB: DEFS 1             ; GAME STATUS BYTE
 4FF9          636  PRIOR:  DEFS 1             ; MUSIC PROTECT FLAG
 4FFA          637  SENFLG: DEFS 1             ; SENTRY CONTROL SEIZURE FLAG
 4FFB          638  UMARGT: DEFS 2
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND         COMMENT

 4FFD          639  USERTB: DEFS 2
>4FCE          640  SYSRAM  EQU  (5000H-($-BEGRAM+1))
```

```
ADDR OBJECT     STMT  LABEL    OPCD OPERAND        COMMENT

                642
                643            LIST S,X,T,M
                644            NLIST I
                645    ; **********
                646    ; * HVGSYS *
                647    ; **********

>0008           649   PFUG     EQU  08H            ; POT FUDGE FACTOR
>17DE           650   GFSTRT   EQU  17DEH          ; GUN FIGHT START ADDRESS
>1328           651   CMSTRT   EQU  1328H          ; CHECKMATE START ADDRESS
>1020           652   CALCST   EQU  1020H          ; CALCULATOR START ADDRESS
>0E19           653   SCBST:   EQU  0E19H          ; SCRIBBLING START ADDRESS

                655    ; ********************
                656    ; * POWER UP RESTART *
                657    ; ********************
                658            ORG  0
0000 00         659            NOP                 ; WAIT FOR THINGS TO SETTLE DOW
0001 F3         660            DI
0002 AF         661            XOR  A
0003 D308       662            OUT  (CONCM),A      ; *** SET CONSUMER MODE ***
0005 C3610C     663            JP   PWRUP

                665            ORG  8
                666    ; TRANSFER CONTROL TO RESTART HANDLER
0008 C30720     667            JP   2007H          ; VECTOR OUT

000B 1C         669   NUMBAS:  DEFB 1CH
000C 3C         670            DEFB 3CH
000D 1C         671            DEFB 1CH
000E 20         672            DEFB 20H

                674            ORG  16
0010 C30A20     675            JP   200AH          ; RESTART 2
0013 06         676   MENUCL:  DEFB 06H            ; MENU COLORS
0014 FB         677            DEFB 0FBH
0015 07         678            DEFB 07H
0016 52         679            DEFB 52H

                681            ORG  24
0018 C30D20     682            JP   200DH          ; RESTART 3
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND       COMMENT

               684  ; NAME:            PAUSE
               685  ; PURPOSE:         HALT # OF INTERRUPTS
               686  ; INPUT:           B = # OF INTERRUPTS
001B FB        687  MPAUSE: EI
001C 76        688          HALT
001D 10FD      689          DJNZ -1
001F C9        690          RET
```

```
ADDR OBJECT   LABEL   OPCD OPERAND        COMMENT

                      ORG   32
0020 C31020           JP    2010H         ; RESTART 4


              ; NAME: SET WORD
               ; (HL)=DE
0023 73       MSETW:  LD    (HL),E
0024 23               INC   HL
0025 72               LD    (HL),D
0026 C9               RET


                      ORG   40
0028 C31320           JP    2013H         ; RESTART 5


002B 210000   CONC2:  LD    HL,0          ; ZERO OUT HL
002E C9               RET


                      ORG   48
0030 C31620           JP    2016H         ; RESTART 6


0033 00       CKSUM1: DEFB 0              ; CHECKSUM


0034 8B01     ITAB:   DEFW MACTIN         ; INTERRUPT TRANSFER
0036 01               DEFB 1              ; ** SYSTEM REVISION LEVEL


                      ORG   56
               ; NAME:          USER PROGRAM INTERFACE
               ; PURPOSE:       TRANSFER OF CONTROL FROM USER TO SYSTEM
               ; INPUT:         ROUTINE # FOLLOWS INLINE AFTER RST INSTR
               ;                IF L.O. BIT SET, LOAD ARGUMENTS INLINE F
               ; OUTPUT:                  NONE
               ; STACK USE:     18 BYTES TOTAL, 16 BYTES ON EXIT
               ; SIDE EFFECTS:  REGISTERS AF,BC,DE,HL,IX, AND OLD IY SAV
               ; EXPLANATION:
               ;  REGISTERS AF,BC,DE,HL,IX, AND PREVIOUS IY ARE PUSHED
               ; THE NUMBER FOLLOWING THE RST 56 INSTRUCTION IS USED TO
               ; INDEX A JUMP VECTOR GIVING THE STARTING ADDRESS OF THE
               ; SYSTEM ROUTINE TO CALL.  IF OPTIONED, INLINE ARGUMENTS
               ; ARE COPIED INTO THE CONTEXT AREA. FOR ARGUMENT ORDERIN
               ; SEE INTERPRETER DOCUMENTATION AND APPROP. TABLES
               ; A DUMMY RETURN IS INSERTED WHICH, WHEN RETURNED TO BY
               ; SYSTEM ROUTINE, WILL RESTORE THE REGISTER CONTENTS AND
               ; RETURN TO THE USER PROGRAM
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

               734   ;
               735   ;     *** THE UPI HAS BEEN EXTENDED TO SUPPORT USER SUPPLI
               736   ;     ROUTINES.  IF THE CALL INDEX PROVIDED IS NEGATIVE
               737   ;     THEN THE USERS DISPATCH TABLE POINTER (USERTB) IS US
               738   ;     NOTE THAT THE SIGN BIT ISN'T ZAPPED BEFORE BEING
               739   ;     USED AS AN INDEX.  THIS MEANS THAT THE USERS DISPATCH
               740   ;     TABLE POINTER SHOULD POINT 128 BYTES BEFORE THE FIRS
0038 E3        741            EX   (SP),HL        ; RETURN ADDRESS TO HL
0039 F5        742            PUSH AF             ; CREATE CONTEXT
003A C5        743            PUSH BC
003B D5        744            PUSH DE
003C DDE5      745            PUSH IX
003E FDE5      746            PUSH IY
0040 FD210000  747            LD   IY,0           ; POINT IY AT CONTEXT
0044 FD39      748            ADD  IY,SP
0046 7E        749            LD   A,(HL)         ; LOAD OPCODE
0047 23        750            INC  HL
0048 117A02    751            LD   DE,RETN        ; DE = RETURN POINT
004B 1F        752            RRA                 ; SUCK WANTED?
004C 3836      753            JR   C,MINTO-$      ; JUMP IF YES
004E E5        754   INTPE:   PUSH HL             ; SAVE PC
004F D5        755            PUSH DE             ; SAVE DUMMY RETURN
0050 21CB00    756            LD   HL,SYSDPT
0053 07        757            RLCA
0054 5F        758            LD   E,A
0055 1600      759            LD   D,0
0057 17        760            RLA                 ; USER TABLE WANTED?
0058 3003      761            JR   NC,PUSH1-$
005A 2AFD4F    762            LD   HL,(USERTB)    ; YES - LOAD IT
005D 19        763   PUSH1:   ADD  HL,DE
005E 5E        764            LD   E,(HL)
005F 23        765            INC  HL
0060 56        766            LD   D,(HL)
0061 D5        767            PUSH DE
0062 FD660B    768            LD   H,(IY+CBH)
0065 FD6E0A    769            LD   L,(IY+CBL)
0068 FD5603    770   RELD:    LD   D,(IY+CBIXH)
006B FD5E02    771            LD   E,(IY+CBIXL)
006E D5        772            PUSH DE
006F DDE1      773            POP  IX
0071 FD7E09    774            LD   A,(IY+CBA)
0074 FD5605    775   DELOAD:  LD   D,(IY+CBD)
0077 FD5E04    776            LD   E,(IY+CBE)
007A C9        777            RET                 ; CALL VIA RETURN
```

```
ADDR OBJECT      LABEL    OPCD OPERAND        COMMENT

                 ; NAME:           MACRO INTERPRETER
                 ; PURPOSE:        INTERPRETING SEQUENCES OF SYSTEM CALLS
                 ; INPUT:          ADDRESS OF STRING TO INTERPRET PASSED ON
                 ; STACK USE:      NO INCREASE IN DEPTH
                 ; EXPLANATION:  IF OPTIONED (BIT 0 OF CALL INDEX SET) THE
                 ; ARGUMENT TABLE (MRARGT) IS INDEXED GIVING A MASK WHICH
                 ; SPECIFIES HOW TO TRANSFER INLINE ARGUMENTS INTO THE CO
                 ; BLOCK.   THIS MASK IS FORMATED AS FOLLOWS:
                 ;
                 ;
                 ; *********************************
                 ; * 7 * 6 * 5 * 4 * 3 * 2 * 1 * 0 *
                 ; *********************************
                 ; * H * L * A * IX* B * C * D * E *
                 ; *********************************
                 ; ARGUMENTS MUST FOLLOW THE CALL INDEX IN THE FOLLOWING
                 ; (OMITING UNUSED ARGUMENTS, OF COURSE)
                 ; (INDEX),IXL,IXH,E,D,C,B,A,L,H
                 ;
                 ;        THE SIMULATED PC IS SAVED AND A DUMMY RETURN IS
                 ; INSERTED ON THE STACK.  THE UPI DISPATCHING ROUTINE IS
                 ; THEN ENTERED AT 'INTPE', WHICH EFFECTS A CONTROL TRANS
                 ; TO THE CALLED ROUTINE.  WHEN THE CALLED ROUTINE RETURN
                 ; IT WILL COME BACK HERE TO INTERPRET THE NEXT MACRO INS
                 ; NOTE THAT THIS ROUTINE IS REENTRANT, THEREFORE THE CAL
                 ; ROUTINE MAY RECUR BACK THRU HERE, IF IT FEELS LIKE IT.
                 ; ** THE UPI HAS BEEN EXTENDED TO SUPPORT USER PROVIDED
                 ; SYSTEM ROUTINES. IF A NEGATIVE CALL INDEX IS ENCOUNTER
                 ; BY THE INTERPRETER, AND 'SUCK INLINE' IS OPTIONED, THE
                 ; USER MACRO ROUTINE ARGUMENT TABLE IS INDEXED FOR A
                 ; PARAMETER MASK.  THE ADDRESS OF THIS TABLE IS ASSUMED
                 ; TO BE IN (UMARGT),(UMARGT+1).   THIS POINTER SHOULD
                 ; POINT 64 BYTES BEFORE THE FIRST REAL ENTRY.
                 ; I.E. LD      HL,USERMT-64     ; WHERE USERMT POINTS AT
                 ;      LD      (UMARGT),HL
007B D1          MINTPC: POP  DE             ; DISCARD DUMMY RETURN FROM UPI
007C             RENTER:
007C E1                  POP  HL             ; POP OFF PC


                 ; NAME:           MCALL
                 ; PURPOSE:        CALL INTERPRETER SUBROUTINE
                 ; INPUT:          HL = ROUTINE ADDRESS
                 ; NOTES:          ROUTINE MAY BE CALLED FROM MACHINE LANGUA
                 ;                 ANOTHER INTERPRETED SEQUENCE
                 ;                 STACK DEPTH INCREASED BY 4 BY CALL
007D 7E          MMCALL: LD   A,(HL)         ; GET OPCODE
007E 23                  INC  HL
007F CB3F                SRL  A
0081 117C00              LD   DE,RENTER      ; LOAD INTERPRETER DUMMY RETURN
0084 D5          MINTO:  PUSH DE             ; SAVE DUMMY RETURN
0085 4F                  LD   C,A            ; INDEX TO C
0086 3012                JR   NC,MINT2-$     ; JUMP IF NO LOAD WANTED
0088 EB                  EX   DE,HL
0089 0600                LD   B,0
```

```
ADDR OBJECT   STMT  LABEL    OPCD OPERAND        COMMENT

008B 214B01                  LD   HL,MRARGT      ; LOAD SYSTEM ARG TABLE
008E CB77                    BIT  6,A            ; USE USER TABLE?
0090 2803                    JR   Z,MINT1-$      ; JUMP IF NO
0092 2AFB4F                  LD   HL,(UMARGT)
0095 09             MINT1:   ADD  HL,BC          ; INDEX TABLE
0096 46                      LD   B,(HL)
0097 CDA800                  CALL MSUCK1         ; CALL SUCK ROUTINE
009A D1             MINT2:   POP  DE             ; DUMMY RETURN TO DE, HL = PC
009B 79                      LD   A,C            ; GET CALL INDEX BACK
009C FD4607                  LD   B,(IY+CBB)     ; RESTORE CLOBBERED REGISTERS
009F FD4E06                  LD   C,(IY+CBC)
00A2 18AA                    JR   INTPE-$        ; JOIN NORMAL UPI DISPATCH SEQU

                     ; NAME:           SUCK INLINE ARGUMENTS
                     ; PURPOSE:        TRANSFER OF INLINE ARGS INTO CONTEXT BLO
                     ; INPUT:          B = ARG LOAD MASK (SEE INTERPRETER COMME
                     ; OUTPUT:         HL = UPDATED PC
                     ; EXPLANATION: THIS ROUTINE IMPLEMENTS A MACRO LOAD INST
                     ; IT IS USED BY THE INTERPRETER AS WELL.  A ONE BIT IN T
                     ; INLINE LOAD MASK MEANS TRANSFER THE NEXT INLINE BYTE I
                     ; A ZERO BIT MEANS 'ADVANCE CONTEXT BLOCK POINTER'
                     ; TWO ENTRY POINTS ARE DEFINED, ONE FOR THE SUCK MACRO I
                     ; THE OTHER FOR THE INTERPRETER TO USE
                     ; SUCK MACRO ENTRY:
00A4 E1             MSUCK:   POP  HL             ; RETURN ADDRESS TO HL
00A5 D1                      POP  DE             ; POP OFF PC
                      ; *** BYTE SAVING TRICK *** REPLACE WITH LD HL,REENTRY
00A6 23                      INC  HL             ; ADVANCE TO REENTRY (MINTO)
00A7 E5                      PUSH HL
                      ; FALL INTO ...
00A8 CB60           MSUCK1:  BIT  4,B            ; IX LOAD WANTED?
00AA 280A                    JR   Z,MSUCK2-$     ; MSUCK2 IF NOT
00AC 1A                      LD   A,(DE)
00AD 13                      INC  DE
00AE FD7702                  LD   (IY+CBIXL),A
00B1 1A                      LD   A,(DE)
00B2 13                      INC  DE
00B3 FD7703                  LD   (IY+CBIXH),A
00B6 FDE5           MSUCK2:  PUSH IY             ; LET HL = IY
00B8 E1                      POP  HL
00B9 23                      INC  HL             ; + 4
00BA 23                      INC  HL
00BB 23                      INC  HL
00BC 23                      INC  HL
00BD CBA0                    RES  4,B            ; KILL IX BIT
                      ;  SUCK IN LOOP
00BF CB38           MSUCK3:  SRL  B
00C1 3003                    JR   NC,MSUCK5-$    ; MSUCK5 IF NOT THIS TIME
00C3 1A                      LD   A,(DE)         ; GET INLINE BYTE
00C4 13                      INC  DE
00C5 77                      LD   (HL),A         ; STUFF INTO CB
00C6 23             MSUCK5:  INC  HL             ; BUMP CB POINTER
                     ; ** THIS CODE ASSUMES THAT STATUS OF 'SRL' IS PRESERVE
00C7 20F6                    JR   NZ,MSUCK3-$    ; JUMP BACK IF MORE TO DO
00C9 EB                      EX   DE,HL          ; HL = PC
00CA C9                      RET                 ; THEN QUIT
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND          COMMENT

                890     ;  *****************************
                891     ;  * UPI ROUTINE ADDRESS TABLE *
                892     ;  *****************************
00CB 7B00       893  SYSDPT:  DEFW MINTPC
00CD 7902       894           DEFW MXINTC
00CF 3206       895           DEFW MRCALL
00D1 7D00       896           DEFW MMCALL
00D3 730B       897           DEFW MMRET
00D5 C40A       898           DEFW MMJUMP
00D7 A400       899           DEFW MSUCK
00D9 8B01       900           DEFW MACTIN
00DB 7E04       901           DEFW TIMEY
00DD 0805       902           DEFW MUZSET
00DF FC05       903           DEFW MUZSTP
00E1 CF03       904           DEFW MSETUP
00E3 DB01       905           DEFW MCOLOR
00E5 EE0A       906           DEFW MFILL
00E7 B206       907           DEFW MPAINT
00E9 FE06       908           DEFW MVWRIT
00EB 0B07       909           DEFW MWRITR
00ED 1507       910           DEFW MWRITP
00EF 1907       911           DEFW MWRIT
00F1 1C07       912           DEFW MWRITA
00F3 7D07       913           DEFW MVBLAN
00F5 9E07       914           DEFW MBLANK
00F7 B903       915           DEFW MSAVE
00F9 AD07       916           DEFW MREST
00FB 6A02       917           DEFW MSCROL
00FD E107       918           DEFW DISPCH
00FF C407       919           DEFW STRNEW
0101 EB0B       920           DEFW BCDISP
0103 F60A       921           DEFW MRELAB
0105 FB0A       922           DEFW MRELA1           ; RELAB1
0107 5606       923           DEFW MVECTC
0109 3306       924           DEFW MVECT
010B C90A       925           DEFW MKCTAS
010D AC01       926           DEFW MENTRY           ; SENTRY
010F 0C06       927           DEFW MDOIT            ; DOIT
0111 0B06       928           DEFW MDOITB
0113 BA01       929           DEFW MPIZBK           ; PIZBRK
0115 970C       930           DEFW MMENU
0117 FB0C       931           DEFW MGETP
0119 310D       932           DEFW MGETN
011B 1B00       933           DEFW MPAUSE           ; PAUSE
011D CC0B       934           DEFW MDISTI           ; DISPLAY TIME
011F 150C       935           DEFW MINCSC           ; INC SCORE
0121 760B       936           DEFW INXNIB           ; INDEXN
0123 900B       937           DEFW PUTNIB           ; STOREN
0125 AC0B       938           DEFW MINDW            ; INDEXW
0127 BD0B       939           DEFW MINDB            ; INDEXB
0129 4B0B       940           DEFW MMOVE            ; MOVE
012B AA0D       941           DEFW MSHFTU
012D 2103       942           DEFW BCDAD
012F 1F03       943           DEFW BCDSB
0131 DE02       944           DEFW BCDML
0133 8402       945           DEFW BCDDV
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

0135 6403       946           DEFW BCDCS
0137 4103       947           DEFW BCDNG
0139 6E03       948           DEFW SDADD
013B 2903       949           DEFW SDSMG
013D 5603       950           DEFW SDABS
013F 4C03       951           DEFW SNEGT
0141 7F03       952           DEFW MRANGE
0143 410C       953           DEFW MQUIT
0145 6C03       954           DEFW MSETB
0147 2300       955           DEFW MSETW
0149 4002       956           DEFW MMTD



                958    ; MACRO ROUTINES ARGUMENT MASK TABLE
                959    ; FORMAT:
                960    ; *********************************
                961    ; * 7 * 6 * 5 * 4 * 3 * 2 * 1 * 0 *
                962    ; *********************************
                963    ; * H * L * A * IX* B * C * D * E *
                964    ; *********************************
                965    ; ARGUMENTS MUST FOLLOW THE CALL INDEX IN THE FOLLOWING
                966    ; (OMITING UNUSED ARGUMENTS, OF COURSE)
                967    ; (INDEX),IXL,IXH,E,D,C,B,A,L,H
014B 00         968   MRARGT: DEFB 0             ; INTPC
014C 00         969           DEFB 0             ; XINTC
014D C0         970           DEFB 11000000B     ; RCALL
014E C0         971           DEFB 11000000B     ; MCALL
014F 00         972           DEFB 0             ; MRET
0150 C0         973           DEFB 11000000B     ; MJUMP
0151 08         974           DEFB 00001000B     ; SUCK
0152 00         975           DEFB 0             ; ACTINT
0153 04         976           DEFB 00000100B     ; DECCTS
0154 F0         977           DEFB 11110000B     ; BMUSIC
0155 00         978           DEFB 0             ; EMUSIC
0156 2A         979           DEFB 00101010B     ; SETOUT
0157 C0         980           DEFB 11000000B     ; COLSET
0158 2F         981           DEFB 00101111B     ; FILL
0159 2F         982           DEFB 00101111B     ; RECTAN
015A D0         983           DEFB 11010000B     ; VWRITR
015B E3         984           DEFB 11100011B     ; WRITR
015C E3         985           DEFB 11100011B     ; WRITP
015D EF         986           DEFB 11101111B     ; WRIT
015E EF         987           DEFB 11101111B     ; WRITA
015F 13         988           DEFB 00010011B     ; VBLANK
0160 CB         989           DEFB 11001011B     ; BLANK
0161 CF         990           DEFB 11001111B     ; SAVE
0162 C3         991           DEFB 11000011B     ; RESTORE
0163 CF         992           DEFB 11001111B     ; SCROLL
0164 27         993           DEFB 00100111B     ; NEW DISCHR
0165 C7         994           DEFB 11000111B     ; NEW DISSTR
0166 CF         995           DEFB 11001111B     ; DISNUM
0167 20         996           DEFB 00100000B     ; RELABS
0168 20         997           DEFB 00100000B     ; RELAB1
0169 D4         998           DEFB 11010100B     ; VECTC
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

016A D0         999           DEFB 11010000B     ; VECT
016B 00        1000           DEFB 0             ; KCTASC
016C 03        1001           DEFB 00000011B     ; SENTRY
016D C0        1002           DEFB 11000000B     ; DOIT
016E C0        1003           DEFB 11000000B     ; DOITB
016F 00        1004           DEFB 0             ; PIZBRK
0170 C3        1005           DEFB 11000011B     ; MENU
0171 EC        1006           DEFB 11101100B     ; GET PARAMETER
0172 CF        1007           DEFB 11001111B     ; GET NUMBER
0173 08        1008           DEFB 00001000B     ; PAUSE
0174 07        1009           DEFB 00000111B     ; DISTIM
0175 C0        1010           DEFB 11000000B     ; INCSCR
0176 C0        1011           DEFB 11000000B     ; INDEXN
0177 C0        1012           DEFB 11000000B     ; STOREN
0178 C0        1013           DEFB 11000000B     ; INDEXW
0179 C0        1014           DEFB 11000000B     ; INDEXB
017A CF        1015           DEFB 11001111B     ; MOVE
017B C8        1016           DEFB 11001000B     ; SHIFTU
017C CB        1017           DEFB 11001011B     ; BCDADD
017D CB        1018           DEFB 11001011B     ; BCDSUB
017E CB        1019           DEFB 11001011B     ; BCDMUL
017F CB        1020           DEFB 11001011B     ; BCDDIV
0180 C8        1021           DEFB 11001000B     ; BCDCHS
0181 0B        1022           DEFB 00001011B     ; BCDNEG
0182 CB        1023           DEFB 11001011B     ; DADD
0183 0B        1024           DEFB 00001011B     ; DSMG
0184 0B        1025           DEFB 00001011B     ; DABS
0185 C8        1026           DEFB 11001000B     ; NEGT
0186 20        1027           DEFB 00100000B     ; RANGED
0187 00        1028           DEFB 00000000B     ; QUIT
0188 E0        1029           DEFB 11100000B     ; SET BYTE
0189 C3        1030           DEFB 11000011B     ; SET WORD
018A C7        1031           DEFB 11000111B     ; MASK TO DELTAS



               1033   ; DOES 4 60TH SEC COUNTERS IN CT0-3
018B F3        1034  MACTIN:  DI                  ; MAKE SURE INTERRUPT IS DISABL
018C F5        1035           PUSH AF
018D C5        1036           PUSH BC
018E D5        1037           PUSH DE
018F E5        1038           PUSH HL
0190 ED5E      1039           IM   2
0192 3E00      1040           LD   A,ITAB.SHR.8
0194 ED47      1041           LD   I,A
0196 3EC8      1042           LD   A,200
0198 D30F      1043           OUT  (INLIN),A
019A 3E34      1044           LD   A,ITAB&0FFH
019C D30D      1045           OUT  (INFBK),A
019E CDA004    1046           CALL TIMEZ          ; UPDATE TIMOUT,MUSIC AND SECON
01A1 0E0F      1047           LD   C,0FH          ; USE CT0-3
01A3 CD7E04    1048           CALL TIMEY          ; DEC CT0-3
01A6 E1        1049           POP  HL
01A7 D1        1050           POP  DE
01A8 C1        1051           POP  BC
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

01A9 F1        1052           POP  AF
01AA FB        1053           EI
01AB C9        1054           RET



               1056  ; ROUTINE: SENTRY
               1057  ; PURPOSE: TO WAIT FOR CHANGE OF PROGRAM STATUS
               1058  ; IN EITHER THE PORTS OR THE TIMER-COUNTERS.
               1059  ; IN ADDITION IT CHECKS TIMOUT FOR LONG PERIODS OF IN-
               1060  ; ACTIVITY.
               1061  ; ** IS VECTOR OUT FLAG SET??
01AC 3AFA4F    1062  MENTRY: LD   A,(SENFLG)
01AF FEAA      1063          CP   0AAH
01B1 CA1920    1064          JP   Z,2019H       ; YES - JUMP OUT
01B4 3AEC4F    1065          LD   A,(TIMOUT)    ; CHECK IF TIME TO BLAKOUT
01B7 B7        1066          OR   A
01B8 202B      1067          JR   NZ,TTEST-$
01BA AF        1068  MPIZBK: XOR  A             ; TIME TO SHUT DOWN
01BB F3        1069          DI
01BC D315      1070          OUT  (VOLC),A      ; TURN OFF SOUNDS
01BE D316      1071          OUT  (VOLAB),A
01C0 010B08    1072          LD   BC,COLBX+8*256
01C3 ED79      1073          OUT  (C),A         ; PAINT IT BLACK
01C5 10FC      1074          DJNZ -2
01C7 111402    1075  PBLP:   LD   DE,AKEYS
01CA CDF40C    1076          CALL FINDL3        ; CALL STORE DE INTO CONTEXT RO
01CD CDE501    1077          CALL TTEST         ; WAIT FOR SOMETHING TO HAPPEN
01D0 3C        1078          INC  A
01D1 20E7      1079          JR   NZ,MPIZBK-$
01D3 FD360900  1080          LD   (IY+CBA),0
01D7 FB        1081          EI
01D8 2AE84F    1082          LD   HL,(COLLST)   ; GET SAVED COLORS
01DB 22E84F    1083  MCOLOR: LD   (COLLST),HL   ; SAVE COLORS FOR FUTURE
01DE 010B08    1084          LD   BC,800H+COLBX
01E1 EDB3      1085          OTIR               ; RESET THE COLORS
01E3 AF        1086          XOR  A
01E4 C9        1087          RET
01E5 CDEC03    1088  TTEST   CALL TRCHK
01E8 FD7709    1089          LD   (IY+CBA),A
01EB FD7007    1090          LD   (IY+CBB),B
01EE FE13      1091          CP   SKYD
01F0 D8        1092          RET  C
01F1 FE1C      1093          CP   POTO
01F3 D0        1094          RET  NC
01F4 3EFF      1095          LD   A,0FFH
01F6 32EC4F    1096          LD   (TIMOUT),A
01F9 C9        1097          RET
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

01FA C40D      1099  CALCL:   DEFW SCBL
01FC DD0D      1100           DEFW PNCALC
01FE 2010      1101           DEFW CALCST         ; START OF CALCULATOR



               1103    ; SYSTEM ROUTINES JUMP VECTOR
               1104           ORG  200H
0200 C3A004    1105           JP   TIMEZ          ; DO TIMER & MUSIC
0203 C37B04    1106           JP   TIMEX          ; DECTMR

0206 20        1108  SYSFNT:  DEFB 20H
0207 08        1109           DEFB 8
0208 08        1110           DEFB 8
0209 01        1111           DEFB 1
020A 07        1112           DEFB 7
020B E408      1113           DEFW LRGCHR

020D A0        1115  SMLFNT:  DEFB 0A0H
020E 04        1116           DEFB 4
020F 06        1117           DEFB 6
0210 01        1118           DEFB 1
0211 05        1119           DEFB 5
0212 BF0A      1120           DEFW SMLCHR

               1122  ; ALLKEYS MASK
0214 3F        1123  AKEYS    DEFB 3FH
0215 3F        1124           DEFB 3FH
0216 3F        1125           DEFB 3FH
0217 3F        1126           DEFB 3FH

               1128  ; HEAD OF ONBOARD MENU
0218 BE0D      1129  GUNLNK:  DEFW CML
021A CA0D      1130           DEFW PNGF
021C DE17      1131           DEFW GFSTRT
021E 4D415820  1132           DEFM 'MAX SCORE'
0227 00        1133           DEFB 0
0228 23204F46  1134           DEFM '# OF PLAYERS'
0234 00        1135           DEFB 0
0235 23204F46  1136           DEFM '# OF GAMES'
023F 00        1137           DEFB 0
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

               1139  ; NAME:           CONVERT MASK TO DELTAS
               1140  ; INPUT:          B = JOYSTICK MASK
               1141  ;                 C = FLOP STATUS (MR FLOP BIT SET IF FLOP
               1142  ;                 DE = X POSITIVE DELTA
               1143  ;                 HL = Y POSITIVE DELTA
0240 CD5602    1144  MMTD:    CALL CONCPL        ; HANDLE Y
0243 EB        1145           EX   DE,HL
0244 CB71      1146           BIT  MRFLOP,C      ; FLOP SET?
0246 2807      1147           JR   Z,MMTD2-$     ; YES - DOIT
0248 78        1148           LD   A,B           ; NO - GET MASK
0249 E603      1149           AND  3
024B 2801      1150           JR   Z,MMTD1-$
024D 2F        1151           CPL                ; INVERT IF NOT ZERO
024E 47        1152  MMTD1:   LD   B,A
024F CD5602    1153  MMTD2:   CALL CONCPL        ; PROCESS X
0252 EB        1154           EX   DE,HL
0253 C3B80B    1155           JP   STHLDE        ; STORE HL,DE AND QUIT


               1157  ; SUBROUTINE TO CONDITIONALLY COMPLEMENT OR ZERO HL
0256 CB08      1158  CONCPL:  RRC  B
0258 300A      1159           JR   NC,CONC1-$    ; JUMP IF NOT UP
025A 7D        1160           LD   A,L
025B 2F        1161           CPL
025C 6F        1162           LD   L,A
025D 7C        1163           LD   A,H
025E 2F        1164           CPL
025F 67        1165           LD   H,A
0260 23        1166           INC  HL
0261 CB08      1167           RRC  B
0263 C9        1168           RET
0264 CB08      1169  CONC1:   RRC  B             ; DOWN SET?
0266 D8        1170           RET  C             ; QUIT IF SO
0267 C32B00    1171           JP   CONC2         ; JUMP TO ZERO OUT


               1173  ; NAME:           SCROLL MEMORY BLOCK
               1174  ; INPUT:          B = NUMBER OF LINES TO SCROLL
               1175  ;                 C = NUMBER OF BYTES ON LINE TO SCROLL
               1176  ;                 DE = LINE INCREMENT
               1177  ;                 HL = FIRST LINE TO SCROLL
026A AF        1178  MSCROL:  XOR  A
026B C5        1179  MSCRL1:  PUSH BC            ; SAVE COUNTERS
026C D5        1180           PUSH DE
026D 47        1181           LD   B,A
026E EB        1182           EX   DE,HL
026F 19        1183           ADD  HL,DE         ; ADD INCREMENT TO LINE
0270 E5        1184           PUSH HL
0271 EDB0      1185           LDIR               ;
0273 E1        1186           POP  HL
0274 D1        1187           POP  DE
0275 C1        1188           POP  BC
0276 10F3      1189           DJNZ MSCRL1-$
0278 C9        1190           RET
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND       COMMENT

              1192   ; NAME:              MACRO INTERPRETER EXIT WITH CONTEXT REST
              1193   ; PURPOSE:           QUIT INTERPRETING AND GO HOME
0279 E1       1194  MXINTC: POP  HL                ; THROW OUT DUMMY RETURN
              1195   ; NAME:              RETURN FROM SYSTEM CALL
              1196   ; PURPOSE:           RETURNING TO USER AND RESTORATION OF REG
027A E1       1197  RETN:   POP  HL                ; RETURN ADDRESS TO HL
027B FDE1     1198          POP  IY
027D DDE1     1199          POP  IX
027F D1       1200          POP  DE
0280 C1       1201          POP  BC
0281 F1       1202          POP  AF
0282 E3       1203          EX   (SP),HL           ; STK=RETURN, HL=OLD HL
0283 C9       1204          RET

              1206  ; NAME:              BCD DIVIDE
              1207  ;
0284 CDC002   1208  BCDDV:  CALL GNACC             ; GENERATE ACCUMULATOR
0287 E3       1209          EX   (SP),HL           ; HL = ACC, TOP = ARG2
0288 C5       1210          PUSH BC
0289 0600     1211          LD   B,0
028B 79       1212          LD   A,C
028C CB39     1213          SRL  C
028E 09       1214          ADD  HL,BC
028F 4F       1215          LD   C,A
0290 EB       1216          EX   DE,HL             ; HL = ARG1, DE = ACC
0291 EDB0     1217          LDIR                   ; HL = ARG1 FLAG+1
0293 C1       1218          POP  BC
0294 D1       1219          POP  DE
0295 2B       1220          DEC  HL                ;
0296 E3       1221          EX   (SP),HL           ; HL = ARG2, TOP = ARG1 FLAG
0297 C5       1222          PUSH BC
0298 0600     1223          LD   B,0
029A 09       1224          ADD  HL,BC             ; HL = ACC+SIZE/2
029B C1       1225          POP  BC
029C 0D       1226          DEC  C                 ; DECREMENT SIZE
029D EB       1227          EX   DE,HL             ; HL = ARG2, DE = ACC, TOP = AR
029E 1B       1228          DEC  DE                ;
029F 1B       1229  DIV1:   DEC  DE
02A0 AF       1230          XOR  A
02A1          1231          SYSTEM NEGT            ; ARG2 = -ARG2 (10S COMP)
02A1 FF       1231 +        RST  56
02A2 74       1231 +        DEFB NEGT
              1231 +        IF   NEGT.EQ.INTPC
              1231 +        ENDIF
02A3          1232  DIV2:   SYSTEM DADD            ; SUBTRACT UNTIL BORROW
02A3 FF       1232 +        RST  56
02A4 6E       1232 +        DEFB DADD
              1232 +        IF   DADD.EQ.INTPC
              1232 +        ENDIF
02A5 380A     1233          JR   C,DIV3-$
02A7 3C       1234          INC  A                 ; OR UNTIL LOOP COUNT > 99
02A8 27       1235          DAA
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

02A9 20F8      1236           JR   NZ,DIV2-$
02AB E1        1237           POP  HL
02AC 36FF      1238           LD   (HL),0FFH
02AE C1        1239           POP  BC
02AF 186A      1240           JR   MULT6-$
02B1           1241  DIV3:    SYSTEM NEGT
02B1 FF        1241 +         RST  56
02B2 74        1241 +         DEFB NEGT
               1241 +         IF   NEGT.EQ.INTPC
               1241 +         ENDIF
02B3           1242           SYSTEM DADD
02B3 FF        1242 +         RST  56
02B4 6E        1242 +         DEFB DADD
               1242 +         IF   DADD.EQ.INTPC
               1242 +         ENDIF
02B5 E3        1243           EX   (SP),HL        ;  HL = ARG1
02B6 2B        1244           DEC  HL
02B7 77        1245           LD   (HL),A         ;  SAVE ANSWER IN ARG1
02B8 E3        1246           EX   (SP),HL
02B9 0D        1247           DEC  C
02BA 20E3      1248           JR   NZ,DIV1-$
02BC E1        1249           POP  HL
02BD C1        1250           POP  BC
02BE 1855      1251           JR   DIV4-$
               1252  ; SUBROUTINE TO GENERATE ACCUMULATOR ON THE STACK
02C0 DDE1      1253  GNACC:   POP  IX
02C2 AF        1254           XOR  A
02C3 4F        1255           LD   C,A
02C4           1256           SYSTEM DABS         ;ARG1=ABS VALUE
02C4 FF        1256 +         RST  56
02C5 72        1256 +         DEFB DABS
               1256 +         IF   DABS.EQ.INTPC
               1256 +         ENDIF
02C6 EB        1257           EX   DE,HL
02C7           1258           SYSTEM DABS         ;ARG2=ABS VALUE
02C7 FF        1258 +         RST  56
02C8 72        1258 +         DEFB DABS
               1258 +         IF   DABS.EQ.INTPC
               1258 +         ENDIF
02C9 EB        1259           EX   DE,HL          ;FLAG=1 IF NEG ANS, ELSE POS
02CA 67        1260           LD   H,A
02CB 6F        1261           LD   L,A
02CC 78        1262           LD   A,B
02CD E5        1263  MULT1    PUSH HL             ;GENERATE ACC ON STACK
02CE 10FD      1264           DJNZ MULT1-$
02D0 47        1265           LD   B,A            ;RESTORE SIZE
02D1 39        1266           ADD  HL,SP
02D2 C5        1267           PUSH BC             ;  SAVE SIGN
02D3 E5        1268           PUSH HL             ;SAVE STACK POINTER
02D4 E5        1269           PUSH HL             ;SAVE ACC POINTER
02D5 FD660B    1270           LD   H,(IY+CBH)     ;RESTORE ARG2 POINTER
02D8 FD6E0A    1271           LD   L,(IY+CBL)
02DB 48        1272           LD   C,B
02DC DDE9      1273           JP   (IX)
               1274           ;DECIMAL MULTIPLY
               1275           ;GIVEN:    DE>ARG1, HL>ARG2, B=SIZE/2
               1276           ;          (SIZE/2-1 ASSUMED EVEN)
```

```
ADDR OBJECT   STMT   LABEL   OPCD OPERAND         COMMENT

              1277           ;RETURNED:  ARG1=ANSWER, C>0 ON OVERFLOW
              1278           ;
              1279           ;
02DE CDC002   1280   BCDML:  CALL GNACC           ; GENERATE ACCUM
02E1 7E       1281   MULT2   LD   A,(HL)          ;A=MULT LOOP COUNT
02E2 23       1282           INC  HL
02E3 E3       1283           EX   (SP),HL         ;HL>DEC ACC
02E4 A7       1284           AND  A               ;IF A=0, SKIP MULT LOOP
02E5 2809     1285           JR   Z,MULT4-$
02E7 EB       1286           EX   DE,HL
02E8          1287   MULT3:  SYSTEM DADD          ; ELSE MULTIPLY
02E8 FF       1287 +         RST  56
02E9 6E       1287 +         DEFB DADD
              1287 +         IF   DADD.EQ.INTPC
              1287 +         ENDIF
02EA A7       1288           AND  A               ; CLEAR THE CARRY BIT
02EB 3D       1289           DEC  A               ;DECIMAL DECREMENT
02EC 27       1290           DAA
02ED 20F9     1291           JR   NZ,MULT3-$
02EF EB       1292           EX   DE,HL
02F0 23       1293   MULT4:  INC  HL              ;INCREMENT DECIMAL ACC
02F1 E3       1294           EX   (SP),HL         ;HL>ARG2
02F2 0D       1295           DEC  C
02F3 20EC     1296           JR   NZ,MULT2-$
02F5 E1       1297           POP  HL
02F6 E1       1298           POP  HL              ;RESTORE STACK POINTER
02F7 C1       1299           POP  BC              ; RESTORE SIGN
02F8 D5       1300           PUSH DE
02F9 C5       1301           PUSH BC
02FA 48       1302           LD   C,B
02FB 0600     1303           LD   B,0
02FD CB39     1304           SRL  C
02FF 09       1305           ADD  HL,BC
0300 CB21     1306           SLA  C
0302 EDB0     1307           LDIR
0304 C1       1308           POP  BC
0305 C5       1309           PUSH BC              ;CHECK FOR OVERFLOW
0306 CB38     1310           SRL  B
0308 AF       1311           XOR  A
0309 B6       1312   MULT5:  OR   (HL)
030A 23       1313           INC  HL
030B 10FC     1314           DJNZ MULT5-$
030D A7       1315           AND  A               ; SET FLAGS
030E 2803     1316           JR   Z,MULT7-$
0310 3EFF     1317           LD   A,0FFH
0312 12       1318           LD   (DE),A
0313 C1       1319   MULT7:  POP  BC              ;CHECK SIGN AND
0314 E1       1320           POP  HL
0315 CB41     1321   DIV4:   BIT  0,C             ;NEGATE ARG1 IF NECESSARY
0317 2802     1322           JR   Z,MULT6-$
0319          1323           SYSTEM BCDCHS
0319 FF       1323 +         RST  56
031A 6A       1323 +         DEFB BCDCHS
              1323 +         IF   BCDCHS.EQ.INTPC
              1323 +         ENDIF
031B E1       1324   MULT6:  POP  HL              ;RESTORE ORIGINAL STACK POINTER
031C 10FD     1325           DJNZ MULT6-$
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ADDR OBJECT   STMT  LABEL    OPCD OPERAND       COMMENT

031E C9       1326           RET
              1327           ;BCD SUBTRACT & ADD
              1328           ;
              1329           ;GIVEN:      DE>ARG1, HL>ARG2
              1330           ;            B=SIZE/2+1
              1331           ;RETURNED:  ARG1=ANSWER
031F          1332  BCDSB:   SYSTEM BCDCHS
031F FF       1332 +         RST  56
0320 6A       1332 +         DEFB BCDCHS
              1332 +         IF   BCDCHS.EQ.INTPC
              1332 +         ENDIF
0321          1333  BCDAD:   SYSTEM BCDNEG
0321 FF       1333 +         RST  56
0322 6C       1333 +         DEFB BCDNEG
              1333 +         IF   BCDNEG.EQ.INTPC
              1333 +         ENDIF
0323 EB       1334           EX   DE,HL
0324          1335           SYSTEM BCDNEG
0324 FF       1335 +         RST  56
0325 6C       1335 +         DEFB BCDNEG
              1335 +         IF   BCDNEG.EQ.INTPC
              1335 +         ENDIF
0326 EB       1336           EX   DE,HL
0327          1337           SYSTEM DADD
0327 FF       1337 +         RST  56
0328 6E       1337 +         DEFB DADD
              1337 +         IF   DADD.EQ.INTPC
              1337 +         ENDIF
              1338  ;  AND FALL INTO
              1339           ;
              1340           ;
              1341           ;DECIMAL SIGNED MAGNITUDE
              1342           ;
              1343           ;GIVEN:      DE>ARG (10'S COMPLEMENT)
              1344           ;            B=SIZE/2+1
              1345           ;RETURNED:  ARG (SIGNED MAGNITUDE)
              1346           ;
0329 68       1347  SDSMG:   LD   L,B             ;HL>ARG+B-1 (SIGN BYTE)
032A 2D       1348           DEC  L
032B 2600     1349           LD   H,0
032D 19       1350           ADD  HL,DE
032E 7E       1351           LD   A,(HL)          ;IF POS (SIGN NIBBLE<5)
032F FE50     1352           CP   50H
0331 D8       1353           RET  C               ;EXIT
0332 EB       1354           EX   DE,HL
0333 3E00     1355  SDSMG1:  LD   A,0             ;ELSE 10'S COMPLEMENT
0335 9E       1356           SBC  A,(HL)
0336 27       1357           DAA
0337 77       1358           LD   (HL),A
0338 23       1359           INC  HL
0339 10F8     1360           DJNZ SDSMG1-$
033B 2B       1361           DEC  HL              ;AND SET SIGN BIT
033C 7E       1362           LD   A,(HL)
033D F680     1363           OR   80H
033F 77       1364           LD   (HL),A
0340 C9       1365           RET
              1366           ;
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ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

              1367          ;
              1368          ;BCD NEGATE
              1369          ;
              1370          ;GIVEN:     DE>ARG (SIGNED MAGNITUDE)
              1371          ;           B=SIZE/2+1
              1372          ;RETURNED:  ARG (10'S COMPLEMENT)
              1373          ;
0341 68       1374  BCDNG:  LD   L,B          ;HL>ARG+B-1 (SIGN BYTE)
0342 2D       1375          DEC  L
0343 2600     1376          LD   H,0
0345 19       1377          ADD  HL,DE
0346 CB7E     1378          BIT  7,(HL)       ;EXIT IF POS
0348 C8       1379          RET  Z
0349 3600     1380          LD   (HL),0       ; CLEAR SIGN BYTE
034B EB       1381          EX   DE,HL
034C AF       1382  SNEGT:  XOR  A            ; CLEAR CARRY
034D 3E00     1383  BCDNG1: LD   A,0          ;ELSE 10'S COMPLEMENT
034F 9E       1384          SBC  A,(HL)
0350 27       1385          DAA
0351 77       1386          LD   (HL),A
0352 23       1387          INC  HL
0353 10F8     1388          DJNZ BCDNG1-$
0355 C9       1389          RET
              1390          ;
              1391          ;
              1392          ;DECIMAL ABSOLUTE
              1393          ;
              1394          ;GIVEN:     DE>ARG (SIGNED MAGNITUDE)
              1395          ;           B=SIZE/2+1
              1396          ;RETURNED:  C=C+1 IF SIGN BIT CLEARED
              1397          ;
0356 68       1398  SDABS:  LD   L,B
0357 2600     1399          LD   H,0
0359 2D       1400          DEC  L
035A 19       1401          ADD  HL,DE
035B CB7E     1402          BIT  7,(HL)
035D C8       1403          RET  Z
035E 3600     1404          LD   (HL),0
0360 FD3406   1405          INC  (IY+CBC)
0363 C9       1406          RET
              1407          ;
              1408          ;
              1409          ;BCD CHANGE SIGN
              1410          ;
              1411          ;GIVEN:     HL>ARG  B=SIZE/2+1
              1412          ;           (SIGNED MAGNITUDE)
              1413          ;RETURNED:  ARG SIGN BIT COMPLEMENTED
              1414          ;
0364 48       1415  BCDCS:  LD   C,B
0365 0600     1416          LD   B,0
0367 0D       1417          DEC  C
0368 09       1418          ADD  HL,BC
0369 7E       1419          LD   A,(HL)
036A EE80     1420          XOR  80H
              1421  ; NAME:          SET BYTE
036C 77       1422  MSETB:  LD   (HL),A
036D C9       1423          RET
```

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ADDR OBJECT    STMT   LABEL    OPCD OPERAND       COMMENT

               1424            ;
               1425            ;
               1426            ;DECIMAL ADD
               1427            ;
               1428            ;GIVEN:     DE>ARG1   HL>ARG2 (10'S COMPLEMENT)
               1429            ;           B=SIZE/2+1
               1430            ;RETURNED:  ARG1=ANSWER (10'S COMPLIMENT)
               1431            ;
036E AF        1432   SDADD:   XOR  A
036F 1A        1433   SDADD1:  LD   A,(DE)
0370 8E        1434            ADC  A,(HL)
0371 27        1435            DAA
0372 12        1436            LD   (DE),A
0373 13        1437            INC  DE
0374 23        1438            INC  HL
0375 10F8      1439            DJNZ SDADD1-$
0377 FE99      1440            CP   99H              ;
0379 17        1441            RLA                   ;
037A 2F        1442            CPL                   ;
037B FD7708    1443            LD   (IY+CBFLAG),A ;  SEND BACK STATUS FROM DADD
037E C9        1444            RET


               1446   ;  NAME:             RANGED RANDOM NUMBER
               1447   ;  INPUT:            A = RANGE
               1448   ;  OUTPUT:           A = RANDOM NUMBER (0 TO RANGE-1)
037F F5        1449   MRANGE:  PUSH AF
0380 2AEF4F    1450            LD   HL,(RANSHT)
0383 CDAC03    1451            CALL SHIFTR
0386 011700    1452            LD   BC,23
0389 09        1453            ADD  HL,BC
038A 8A        1454            ADC  A,D
038B 22EF4F    1455            LD   (RANSHT),HL
038E 2AF14F    1456            LD   HL,(RANSHT+2)
0391 5F        1457            LD   E,A
0392 CDAC03    1458            CALL SHIFTR
0395 19        1459            ADD  HL,DE
0396 22F14F    1460            LD   (RANSHT+2),HL
0399 5A        1461            LD   E,D
039A EB        1462            EX   DE,HL
039B F1        1463            POP  AF
039C A7        1464            AND  A
039D 4F        1465            LD   C,A
039E 7A        1466            LD   A,D
039F 2808      1467            JR   Z,R3-$
03A1 AF        1468            XOR  A
03A2 19        1469   R1:      ADD  HL,DE
03A3 3001      1470            JR   NC,R2-$
03A5 3C        1471            INC  A
03A6 0D        1472   R2:      DEC  C
03A7 20F9      1473            JR   NZ,R1-$
03A9 C3D10A    1474   R3:      JP   QFROG
03AC 44        1475   SHIFTR:  LD   B,H
03AD 4D        1476            LD   C,L
03AE AF        1477            XOR  A
03AF 1607      1478            LD   D,7
```

```
ADDR OBJECT   STMT  LABEL     OPCD OPERAND       COMMENT

03B1 29       1479  SH1:      ADD  HL,HL
03B2 17       1480            RLA
03B3 15       1481            DEC  D
03B4 20FB     1482            JR   NZ,SH1-$
03B6 09       1483            ADD  HL,BC
03B7 8A       1484            ADC  A,D
03B8 C9       1485            RET

              1487  ; NAME:             SAVE AREA
              1488  ; INPUT:            HL = SCREEN ADDRESS
              1489  ;                   DE = SAVE AREA ADDRESS
              1490  ;                   BC = Y,X SIZE OF AREA TO SAVE
              1491  ; NOTES:            THE SIZES OF THE OBJECT ARE SAVED IN THE
              1492  ;                   FIRST TWO BYTES OF THE SAVE AREA.
03B9 EB       1493  MSAVE:    EX   DE,HL
03BA 71       1494            LD   (HL),C        ; SET X SIZE
03BB 23       1495            INC  HL
03BC 70       1496            LD   (HL),B        ; SET Y SIZE
03BD 23       1497            INC  HL
03BE AF       1498            XOR  A
03BF EB       1499            EX   DE,HL
03C0 CBF4     1500            SET  6,H           ; SET NONMAGIC ADDRESS
03C2 C5       1501  MSAVE1:   PUSH BC
03C3 E5       1502            PUSH HL
03C4 47       1503            LD   B,A
03C5 EDB0     1504            LDIR
03C7 E1       1505            POP  HL
03C8 0E28     1506            LD   C,BYTEPL
03CA 09       1507            ADD  HL,BC
03CB C1       1508            POP  BC
03CC 10F4     1509            DJNZ MSAVE1-$
03CE C9       1510            RET

              1512   ; NAME: PREGAME OUTPUT PORT SETUP
              1513   ; PURPOSE: TO SET CONCOM,VERBL ETC
              1514   ; INPUTS:  B=HORCB, D=VERBL, A=INMOD
03CF 0E09     1515  MSETUP:   LD   C,HORCB       ; GET BASE PORT NUMBER
03D1 ED41     1516            OUT  (C),B         ; HORBD
03D3 0C       1517            INC  C             ;
03D4 ED51     1518            OUT  (C),D         ; VERBL
03D6 D30E     1519            OUT  (INMOD),A
03D8 C9       1520            RET

              1522  ; NAME: TEST FOR TRANSITIONS
              1523  ; FUNCTION: TO LOOK FOR CHANGES IN THE PORTS &TC.
              1524  ; RETURNS : A= 0 NO CHANGE
              1525  ; 1-8 COUNTER TIMER#N HIT 0
              1526  ; 9-C = POTO-3 CHANGED
              1527  ; D = A SECONDS UP
              1528  ; E= KEYBOARD CHANGED (B=0-24)
              1529  ; F-16 : TRIGO!JOYO - T3!J3
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND         COMMENT

               1530  ; RETURNS NEW VALUE IN B
03D9 5E        1531  CTLP     LD   E,(HL)
03DA 010108    1532           LD   BC,801H
03DD 79        1533  CCTLP    LD   A,C             ; GET MASK
03DE 0F        1534           RRCA
03DF 4F        1535           LD   C,A
03E0 A3        1536           AND  E               ; CHECK IF CT BIT =1
03E1 2003      1537           JR   NZ,CCT1-$
03E3 10F8      1538           DJNZ CCTLP-$
03E5 C9        1539           RET
03E6 AB        1540  CCT1:    XOR  E               ; MASK OUT BIT IN QUESTION
03E7 77        1541           LD   (HL),A          ; PUT BACK THE CTFLAGS OR SEMI4
03E8 78        1542           LD   A,B
03E9 82        1543           ADD  A,D
03EA E1        1544           POP  HL              ; OLD RET ADDR
03EB C9        1545           RET
03EC 2825      1546  TRCHK:   JR   Z,TSEX-$        ; SKIP COUNTER-TIMERS AND POTS?
03EE 21DD4F    1547           LD   HL,CNT          ; GET COUNTER   TIMERS STATUS
03F1 1600      1548           LD   D,0
03F3 CDD903    1549           CALL CTLP            ; COUNTER TIMERS
03F6 1608      1550           LD   D,8
03F8 23        1551           INC  HL
03F9 CDD903    1552           CALL CTLP            ; SEMI4S
03FC 011C04    1553           LD   BC,400H+POTO
03FF 23        1554  TPLOP    INC  HL              ; -> MPOTO
0400 ED78      1555           IN   A,(C)
0402 5E        1556           LD   E,(HL)          ; GET OPOT
0403 93        1557           SUB  E
0404 3805      1558           JR   C,PHOT-$        ; NEW ONE LESS THAN OLD
0406 D608      1559           SUB  PFUG            ; FUDGE BOUNCE FACTOR
0408 3806      1560           JR   C,EPLOP-$       ; NEW MORE THAN OLD+4
040A 3C        1561           INC  A
040B 83        1562  PHOT:    ADD  A,E
040C 77        1563           LD   (HL),A
040D 47        1564           LD   B,A
040E 79        1565           LD   A,C
040F C9        1566           RET
0410 0C        1567  EPLOP    INC  C
0411 10EC      1568           DJNZ TPLOP-$
               1569  ; NOW TEST SECONDS
0413 21E34F    1570  TSEX:    LD   HL,KEYSEX       ; HL = KEYSEX
0416 7E        1571           LD   A,(HL)
0417 CB7F      1572           BIT  7,A
0419 2806      1573           JR   Z,TKEYS-$
041B CBBF      1574           RES  7,A
041D 77        1575           LD   (HL),A
041E 3E11      1576           LD   A,SSEC          ; SECS
0420 C9        1577           RET
               1578  ; NOW TEST KEYBOARD
0421 E5        1579  TKEYS:   PUSH HL
0422 CD7400    1580           CALL DELOAD
0425 EB        1581           EX   DE,HL
0426 011704    1582           LD   BC,400H+KEY3
0429 1100FF    1583           LD   DE,0FF00H       ; SET BIT COUNTER+COLUMNN
042C ED78      1584  MSK1:    IN   A,(C)
042E A6        1585           AND  (HL)            ; CHECK AGAINST MASK
042F 200A      1586           JR   NZ,MSENK2-$
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

0431 0D        1587           DEC  C              ; NEXT PORT
0432 1C        1588           INC  E              ; AND COLUMN
0433 23        1589           INC  HL             ; AND MASK
0434 10F6      1590           DJNZ MSK1-$
0436 78        1591           LD   A,B            ; NOTHING DOWN
0437 1E12      1592           LD   E,SKYU
0439 180B      1593           JR   MSENKE-$
043B 14        1594  MSENK2   INC  D              ; BIT COUNTER
043C 0F        1595           RRCA
043D 30FC      1596           JR   NC,MSENK2-$
043F 7A        1597           LD   A,D
0440 07        1598           RLCA                ; KEY=BIT*4
0441 07        1599           RLCA
0442 83        1600           ADD  A,E            ; + COLUMN
0443 3C        1601           INC  A              ; PLUS 1
0444 1E13      1602           LD   E,SKYD
0446 E1        1603  MSENKE   POP  HL
0447 AE        1604           XOR  (HL)           ; KEY=OKEY?
0448 E67F      1605           AND  7FH
044A 2807      1606           JR   Z,HANDLE-$
044C AE        1607           XOR  (HL)
044D 77        1608           LD   (HL),A
044E E67F      1609           AND  07FH
0450 47        1610           LD   B,A
0451 7B        1611           LD   A,E            ; KEYBOARD RETURN CODE
0452 C9        1612           RET
               1613  ; NOW TEST HANDLES
0453 011004    1614  HANDLE:  LD   BC,400H+SWO
0456 23        1615  SWLOP    INC  HL             ; -> OSWO
0457 ED78      1616           IN   A,(C)
0459 AE        1617           XOR  (HL)           ; COMPARE THE 2
045A 2005      1618           JR   NZ,SWHIT-$
045C 0C        1619           INC  C
045D 10F7      1620           DJNZ SWLOP-$        ; NO CHANGE
045F 78        1621           LD   A,B            ; RETURN 0
0460 C9        1622           RET
0461 CB67      1623  SWHIT:   BIT  4,A            ; TEST TRIGGER
0463 280C      1624           JR   Z,JOYS-$       ; NO TRIG MUST BE JOYSTICK
0465 E610      1625           AND  10H            ; FILTER OUT TRIGGER
0467 AE        1626           XOR  (HL)           ; UPDATE VALUE
0468 77        1627           LD   (HL),A
0469 E610      1628           AND  10H
046B 47        1629           LD   B,A
046C 79        1630           LD   A,C            ; GET PORT NUMBER
046D 07        1631           RLCA                ; *2
046E D60C      1632           SUB  0CH
0470 C9        1633           RET
0471 AE        1634  JOYS:    XOR  (HL)
0472 77        1635           LD   (HL),A         ; NO CHANGE IN TRIG SO STORE ST
0473 E60F      1636           AND  0FH            ; TAKE OFF TRIGGER
0475 47        1637           LD   B,A
0476 79        1638           LD   A,C
0477 07        1639           RLCA                ; *2
0478 D60B      1640           SUB  0BH
047A C9        1641           RET
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND       COMMENT

                    ; TIMEX
                    ; INPUTS HL-> TIME BASE IN RAM
                    ; B=TIME BASE MODULUS
                    ; C=MASK AS IN DECCTS
                    ; PURPOSE: TO DECR TIMEBASE AND IF 0 RESET IF AND DECR
                    ;  COUNTER       TIMERS
047B 35             TIMEX:  DEC  (HL)          ; DEC TIMEBASE
047C C0                     RET  NZ
047D 70                     LD   (HL),B        ; RESET TIMEBASE

                    ; NAME: DECREMENT COUNTER        TIMERS
                    ; INPUTS: C=MASK
                    ; USED BY ACTINT AND DECCTS TO DECREMENTS CTS UNDER MASK
                    ; MASK= *76543210* , IF BIT=1 THEN DEC CORESPONDING
                    ; CT# , IF BIT=0 LEAVE CT# ALONE
                    ; NOTE: ALL COUNTERS ARE RUN IN BCD FOR EASY DISPLAY
047E 0608           TIMEY:  LD   B,8           ; NO OF BITS
0480 21D54F                 LD   HL,CT0        ; -> TO COUNTER TIMERS
0483 1600                   LD   D,0           ; RESULTS
0485 CB39           TIMLP:  SRL  C             ; CHANGE THIS TIMER?
0487 300A                   JR   NC,ETLP-$
0489 7E                     LD   A,(HL)        ; GET THE TIMER
048A B7                     OR   A             ; IS IT ZERO ALREADY?
048B 2806                   JR   Z,ETLP-$
048D 3D                     DEC  A
048E 27                     DAA
048F 2001                   JR   NZ,+3
0491 37                     SCF
0492 77                     LD   (HL),A        ; STORE NEW VALUE
0493 23             ETLP:   INC  HL
0494 CB1A                   RR   D             ; ROTATES IN CARRY FLAG
0496 10ED                   DJNZ TIMLP-$
0498 3ADD4F                 LD   A,(CNT)       ; COUNTER UPDATE&NUMBER TRACKER
049B B2                     OR   D
049C 32DD4F                 LD   (CNT),A
049F C9                     RET

                    ; NAME: TIMER ROUTINE
                    ; PURPOSE: TO UPDATE GAME TIME,TIMOUT AND MUSIC
                    ; INPUTS          OUTPUTS: NONE
                    ; NOTE: PUSH YOUR REGISTERS (AF,BC,DE,HL)
                    TIMEZ:                     ; ASSUMES YOU PUSH DA REGS
04A0 21F94F                 LD   HL,PRIOR      ; PRIORITY=TICKS
04A3 CB4E                   BIT  1,(HL)        ;CHECK IF TICKS OVERRUN
04A5 C0                     RET  NZ            ; RETURN
04A6 CBCE                   SET  1,(HL)
04A8 EB                     EX   DE,HL
                    ;  *SIXTIETH OF A SECOND INTERUPT*
04A9 21EA4F                 LD   HL,DURAT      ; NOTE TIMER
04AC 7E                     LD   A,(HL)        ; =0 SKIP
04AD B7                     OR   A
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

04AE 281C      1694           JR   Z,SIXY-$
04B0 35        1695           DEC  (HL)
04B1 200B      1696           JR   NZ,STAKO-$
04B3 E5        1697           PUSH HL
04B4 DDE5      1698           PUSH IX
04B6 CD1405    1699           CALL MUZCPU         ; =0 DO NEXT NOTE
04B9 DDE1      1700           POP  IX
04BB E1        1701           POP  HL
04BC 180E      1702           JR   SIXY-$
04BE EB        1703  STAKO:   EX   DE,HL
04BF CB7E      1704           BIT  7,(HL)
04C1 EB        1705           EX   DE,HL
04C2 2008      1706           JR   NZ,SIXY-$
04C4 3D        1707           DEC  A
04C5 3D        1708           DEC  A              ; =1 QUIET NOTE
04C6 2004      1709           JR   NZ,SIXY-$
               1710  ; A=0
04C8 D316      1711           OUT  (VOLAB),A
04CA D315      1712           OUT  (VOLC),A
04CC 23        1713  SIXY:    INC  HL
04CD 35        1714           DEC  (HL)           ;IF(--TMR60<0)
04CE F20205    1715           JP   P,GOUT         ; ELZ ONWARD
04D1 363B      1716           LD   (HL),59        ;THEN TMR60=59
04D3 23        1717           INC  HL             ; -> TIMOUT
04D4 EB        1718           EX   DE,HL
04D5 21E34F    1719           LD   HL,KEYSEX      ; SET SECONDS UP
04D8 CBFE      1720           SET  7,(HL)
04DA EB        1721           EX   DE,HL
04DB 7E        1722           LD   A,(HL)         ; CHECK IF ZERO
04DC B7        1723           OR   A
04DD 2801      1724           JR   Z,GTIMER-$
04DF 35        1725           DEC  (HL)           ; DEC TIMOUT
               1726    ; *GAME TIMER ONCE A SECOND ROUTINE*
               1727    ; IF (SEC != 0 & MIN !=0)
               1728    ;     IF (SEC == 0)
               1729    ;        SEC=59;--MIN
               1730    ;     ELSE --SEC
               1731    ; ELSE GAMETIMEUP=1
04E0 23        1732  GTIMER:  INC  HL             ;->GTSECS
04E1 7E        1733           LD   A,(HL)         ;IF (SEC!=0
04E2 23        1734           INC  HL             ;->GTMINS
04E3 B6        1735           OR   (HL)           ; & MIN!=0)
04E4 2813      1736           JR   Z,GT02-$
04E6 2B        1737           DEC  HL             ;->GTSECS AGAIN
04E7 7E        1738           LD   A,(HL)         ;IF (SEC ==0)
04E8 B7        1739           OR   A
04E9 2009      1740           JR   NZ,GT01-$
04EB 3659      1741           LD   (HL),59H       ; THEN SEC=59BCD
04ED 23        1742           INC  HL             ;->GTMINS AGAIN
04EE 7E        1743           LD   A,(HL)         ; --MIN
04EF 3D        1744           DEC  A
04F0 27        1745           DAA
04F1 77        1746           LD   (HL),A
04F2 180E      1747           JR   GOUT-$
04F4 3D        1748  GT01:    DEC  A              ; ELSE --SEC
04F5 27        1749           DAA
04F6 77        1750           LD   (HL),A
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

04F7 1809     1751          JR   GOUT-$
04F9 21F84F   1752  GT02:   LD   HL,GAMSTB     ; ELSE GAMETIMEUP=1
04FC CB46     1753          BIT  GSBTIM,(HL)
04FE 2802     1754          JR   Z,GOUT-$
0500 CBFE     1755          SET  GSBEND,(HL)
0502 21F94F   1756  GOUT    LD   HL,PRIOR
0505 CB8E     1757          RES  1,(HL)
0507 C9       1758          RET                 ;RETURN TO BACKGND OR LO LEVEL
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND          COMMENT

               1760   ; NAME: START MUZCPU
               1761   ; PURPOSE: TO START MUSIC PLAYING (ALSO NOISES)
               1762   ; INPUTS: HL -> SCORE
               1763   ; A=VOICES
               1764   ; NOTE: YOU SHOULD LOAD MUZSP IF YOU DO CALLS
0508 32D44F    1765  MUZSET   LD   (VOICES),A
050B DD22D04F  1766           LD   (MUZSP),IX
050F CDFC05    1767           CALL MUZSTP
0512 1803      1768           JR   MUZCP1-$
               1769   ; NAME: MUZCPU
               1770   ; PURPOSE: PLAYING MUSIC AND NOISES
               1771   ; NOTE: DURAT=0 WHEN CALLED
               1772   ; OUTPUT: NONE
               1773    ; *MUSIC PROCESSOR*
               1774    ;  FETCH OPCODE
               1775    ;  IF (OPCODE < 80H)
               1776    ;       SET NOTE DURATION ETC
               1777    ;  ELSE
               1778    ;  SWITCH (OPCODE & OFOH)
               1779    ;  CASE 80H:
               1780    ;       IF (MASK=8) STUFF SNDBX;PC=PC+9
               1781    ;       ELSE OUTPUT(MASK)=DATA
               1782    ;  CASE 90H:
               1783    ;       VOICES=DATA
               1784    ;  CASE AOH:
               1785    ;        (--SP)=DATA IN NIBBLE OF OP +1
               1786    ;  CASE BOH:
               1787    ;       SET VOLUMES = DATA,DATA
               1788    ;  CASE COH:
               1789    ;       SWITCH (MASK)
               1790    ;             CASE 9: MPCL=(MSP++); MPCH=(MSP++); BREAK
               1791    ;             CASE D: (--MSP)=MPCH; (--MSP)=MPCL
               1792    ;             CASE 0: IF --(SP)==0 THEN SP++
               1793    ;             CASE 3: MPC=DATA16
               1794    ;  CASE DOH: CALL RELATIVE
               1795   ;   CASE EO: DURAT=DATA
               1796    ;  CASE FO: VOICES=0,PORTS=0
0514 2ACE4F    1797  MUZCPU   LD   HL,(MUZPC)    ; LOOK LIKE NORMAL LOOP RETURN
0517 DD2AD04F  1798  MUZCP1   LD   IX,(MUZSP)    ; FETCH STACK POINTER
051B 7E        1799  OPLOOP   LD   A,(HL)        ; OPCODE FETCH
051C 23        1800           INC  HL            ;->OPERAND,DATA
051D B7        1801           OR   A             ; TEST FOR 80H OR MORE
051E FA5B05    1802           JP   M,MOO
               1803     ; NORMAL NOTE OPERATOR
0521 32EA4F    1804           LD   (DURAT),A
0524 3AD44F    1805           LD   A,(VOICES)
0527 011808    1806           LD   BC,800H+SNDBX
052A CB3F      1807           SRL  A             ; SET NOISE
052C 3002      1808           JR   NC,+4
052E EDA3      1809           OUTI
0530 0605      1810           LD   B,5           ; -> VIBRATO
0532 CB3F      1811           SRL  A
0534 3002      1812           JR   NC,+4
0536 EDA3      1813           OUTI               ; SET VIBRATO
0538 0604      1814           LD   B,4           ; -> NOTEC
053A CB3F      1815  M81:     SRL  A             ; CHECK C,B,A
```

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ADDR OBJECT   STMT  LABEL   OPCD OPERAND         COMMENT

053C 3009     1816          JR   NC,M82-$
053E EDA3     1817          OUTI
0540 CB3F     1818  M815    SRL  A               ; CHECK IF INC PC WAS ON
0542 3807     1819          JR   C,M83-$
0544 2B       1820          DEC  HL              ; RESTORE PC
0545 1804     1821          JR   M83-$
0547 05       1822  M82     DEC  B
0548 23       1823          INC  HL
0549 18F5     1824          JR   M815-$
054B B7       1825  M83     OR   A
054C 20EC     1826          JR   NZ,M81-$
              1827  ; PLAY NOTE
054E 3AD24F   1828          LD   A,(PVOLAB)
0551 D316     1829          OUT  (VOLAB),A
0553 3AD34F   1830          LD   A,(PVOLMC)
0556 D315     1831          OUT  (VOLC),A
0558 C3F405   1832          JP   MUZ999
055B FE90     1833  M00:    CP   90H
055D 3015     1834          JR   NC,M01-$
              1835     ; STUFF PORT OR SOUND BLOCK
055F CB5F     1836          BIT  3,A             ; IF (STUFF SNDBLK)
0561 2808     1837          JR   Z,M001-$
0563 78       1838          LD   A,B             ; SAVE B (VSN)
0564 011808   1839          LD   BC,8*256+SNDBX ; B=8,C=SNDBX
0567 EDB3     1840          OTIR                 ; HL->NEXT OPCODE WHEN DONE
0569 18B0     1841          JR   OPLOOP-$
056B E607     1842  M001:   AND  7               ; ISOLATE PORT NUMBER
056D F610     1843          OR   10H             ; PORTS 10H-17H
056F 4F       1844          LD   C,A             ; SET PORT REGISTER
0570 EDA3     1845          OUTI
0572 18A7     1846          JR   OPLOOP-$
0574 2007     1847  M01:    JR   NZ,M02-$
0576 7E       1848          LD   A,(HL)          ; GET NEW VOICES
0577 23       1849          INC  HL
0578 32D44F   1850          LD   (VOICES),A
057B 189E     1851          JR   OPLOOP-$
057D FEB0     1852  M02:    CP   0B0H
057F 3006     1853          JR   NC,M03-$
0581 E60F     1854          AND  0FH
0583 5F       1855          LD   E,A
0584 1C       1856          INC  E
0585 183E     1857          JR   M045-$
0587 FEC0     1858  M03:    CP   0C0H            ; SET VOL ETC
0589 3009     1859          JR   NC,M04-$
              1860  ; LOAD PVOLS
058B 11D24F   1861          LD   DE,PVOLAB
058E EDA0     1862          LDI                  ; DONT CARE ABOUT BC
0590 EDA0     1863          LDI
0592 1887     1864  OPLP2   JR   OPLOOP-$
0594 200B     1865  M04     JR   NZ,M040-$
0596 DD3500   1866          DEC  (IX+0)          ; DEC STACK TOP
0599 200A     1867          JR   NZ,M041-$
059B DD23     1868          INC  IX
059D 23       1869          INC  HL
059E 23       1870          INC  HL
059F 18F1     1871          JR   OPLP2-$
05A1 FED0     1872  M040    CP   0D0H            ; PC SP STUFF
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ADDR OBJECT    LABEL    OPCD OPERAND          COMMENT

05A3 3027               JR   NC,M05-$
05A5 E60F      M041     AND  0FH              ; ISOLATE MASK
05A7 FE09               CP   9                ; RETURN
05A9 200C               JR   NZ,M043-$
05AB DD6E00             LD   L,(IX+0)
05AE DD23               INC  IX
05B0 DD6600             LD   H,(IX+0)
05B3 DD23               INC  IX
05B5 18DB               JR   OPLP2-$
05B7 5E        M043:    LD   E,(HL)           ; PCL=
05B8 23                 INC  HL
05B9 56                 LD   D,(HL)           ; PCH=
05BA 23                 INC  HL
05BB EB                 EX   DE,HL            ; SET THE PC
05BC FE04               CP   4                ; IS IT A JMP?
05BE 38D2               JR   C,OPLP2-$        ; IT IS
05C0 DD2B      M044     DEC  IX               ; ITS A CALL
05C2 DD7200             LD   (IX+0),D         ; (--SP)=PCH
05C5 DD2B      M045     DEC  IX
05C7 DD7300             LD   (IX+0),E         ; (--SP)=PCL
05CA 18C6               JR   OPLP2-$
05CC FEE0      M05:     CP   0E0H
05CE 300A               JR   NC,M06-$
05D0 E60F               AND  0FH
05D2 0600               LD   B,0
05D4 4F                 LD   C,A
05D5 54                 LD   D,H
05D6 5D                 LD   E,L
05D7 09                 ADD  HL,BC
05D8 18E6               JR   M044-$           ; CALL
05DA 200A      M06      JR   NZ,M061-$
05DC 3AF94F             LD   A,(PRIOR)        ; LEGSTA
05DF EE80               XOR  80H
05E1 32F94F             LD   (PRIOR),A
05E4 18AC               JR   OPLP2-$
05E6 FEF0      M061     CP   0F0H             ; REST VOICE (OR SUSTAIN)
05E8 2812               JR   Z,MUZSTP-$
05EA 7E                 LD   A,(HL)
05EB 32EA4F             LD   (DURAT),A        ; SET DURATION OF QUIET
05EE 23                 INC  HL
05EF AF                 XOR  A
05F0 D316               OUT  (VOLAB),A
05F2 D315               OUT  (VOLC),A
                   ; END OF MUZIC PROCESSOR
05F4 22CE4F    MUZ999:  LD   (MUZPC),HL       ; SAVE THE PC
05F7 DD22D04F           LD   (MUZSP),IX       ; SAVE THE STACK POINTER
05FB C9                 RET
               ; NAME MUZSTP
               ; PURPOSE: STOP MUZCPU,SET PORTS TO 0
05FC AF        MUZSTP:  XOR  A
05FD 32EA4F             LD   (DURAT),A
0600 32F94F             LD   (PRIOR),A
0603 011808             LD   BC,800H+SNDBX
0606 ED79               OUT  (C),A
0608 10FC               DJNZ -2
060A C9                 RET
```

```
                      ; NAME: DO IT
                      ; PURPOSE:        TRANSFER CONTROL TO USER STATE TRANSITION
                      ; INPUT:          A = RETURN CODE FROM SENTRY ROUTINE
                      ;             HL = DO IT TABLE ADDRESS
                      ; OUTPUT:
                      ; DESCRIPTION:  THIS ROUTINE IS USED WITH THE SENTRY ROUT
                      ;             IT IS USED FOR DISPATCHING TO A STATE TRANSITION
                      ;             ROUTINE.  THE RETURN CODE FROM SENTRY IS USED TO
                      ;             SEARCH THE DOIT TABLE.  IF A MATCH IS FOUND, CONT
                      ;             TRANSFERED.  IF NO MATCH IS FOUND, THE ROUTINE RE
                      ;             THE DOIT TABLE IS MADE UP OF THREE BYTE ENTRYS:
                      ;             BYTE 0 BIT 7: IF SET - DO A MCALL TO THIS HANDLER
                      ;             BYTE 0 BIT 6: IF SET - DO A RCALL TO THIS HANDLER
                      ;             BYTE 0 BITS 5-0: RETURNCODE THIS ROUTINE IS TO PR
                      ;             BYTE 1 AND 2: THE ADDRESS TO TRANSFER TO.
                      ;             THE LIST IS TERMINATED BY A BYTE WHICH IS .GE. OC
060B 78               MDOITB  LD    A,B
060C D5               MDOIT:  PUSH DE
060D 57                       LD    D,A
060E 7E               MDOIT0: LD    A,(HL)        ; GET RETURN CODE FOR THIS ENTR
060F 4F                       LD    C,A           ; C = CURRENT ENTRY
0610 FEC0                     CP    0C0H          ; LIST TERMINATOR?
0612 3802                     JR    C,MDOIT1-$    ; NO - JUMP
0614 D1                       POP   DE            ; YES - RETURN
0615 C9                       RET
0616 23               MDOIT1: INC   HL
0617 E63F                     AND   3FH
0619 BA                       CP    D             ; NORMAL MATCH?
061A 2804                     JR    Z,MDOIT2-$    ; JUMP IF SO
061C 23               MDO1A:  INC   HL            ; NO MATCH - SKIP OVER
061D 23                       INC   HL            ; GO TO ADDRESS
061E 18EE                     JR    MDOIT0-$
0620 D1               MDOIT2: POP   DE
0621 5E               MDOIT3: LD    E,(HL)        ; DE = GOTO ADDR
0622 23                       INC   HL
0623 56                       LD    D,(HL)
0624 EB                       EX    DE,HL
0625 CB79                     BIT   7,C           ; MCALL?
0627 C27D00                   JP    NZ,MMCALL     ; JUMP IF SO
062A CB71                     BIT   6,C           ; RCALL?
062C 2004                     JR    NZ,MRCALL-$
062E D1                       POP   DE            ; MUST BE JUMP
062F F1                       POP   AF
0630 E5                       PUSH HL
0631 EB                       EX    DE,HL
                      ; RCALL ROUTINE
0632 E9               MRCALL: JP    (HL)
                       ; **********************
                       ; * VECTORING ROUTINES *
                       ; **********************
                       ; NAME:          VECTOR X AND Y COORDINATES
                       ; PURPOSE:       UPDATE X,Y COORDINATES AND LIMIT CHECK
                       ; INPUT:         IX = VECTOR PACKET
                       ;                HL = LIMITS TABLE
                       ; OUTPUT:        C = TIME BASE USED
                       ;                NONZERO STATUS SET IF OBJECT MOVED
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

                      ; NOTES:
                      ;    THIS ROUTINE WORKS WITH A 'VECTOR PACKET', WHICH LOO
                      ; ********************************
                      ; *BYTE*     CONTENTS     * NAME   *
                      ; ********************************
                      ; * 00 * MAGIC REGISTER * VBMR   *
                      ; ********************************
                      ; * 01 * VECTOR STATUS  * VBSTAT *
                      ; ********************************
                      ; * 02 * TIME BASE      * VBTIMB *
                      ; ********************************
                      ; * 03 * DELTA X        * VBDXL  *
                      ; * 04 *                * VBDXH  *
                      ; ********************************
                      ; * 05 * X COORDINATE   * VBXL   *
                      ; * 06 *                * VBXH   *
                      ; ********************************
                      ; * 07 * X CHECKS MASK  * VBXCHK *
                      ; ********************************
                      ; * 08 * DELTA Y        * VBDYL  *
                      ; * 09 *                * VBDYH  *
                      ; ********************************
                      ; * 0A * Y COORDINATE   * VBYL   *
                      ; * 0B *                * VBYH   *
                      ; ********************************
                      ; * 0C * Y CHECKS MASK  * VBYCHK *
                      ; ********************************
                      ;
                      ; OPTIONS BYTE:
                      ; BIT  MEANING
                      ; ---  -------
                      ;  7   VECTOR IS ACTIVE
                      ;
                      ; CHECKS BYTE:
                      ; BIT  MEANING
                      ; ---  -------
                      ;  0   DO LIMIT CHECKS
                      ;  1   REVERSE COORDINATES ON LIMIT ATTAINMENT
                      ;  3   TARGET ATTAINED (OUTPUT)
                      ;    IF THE VECTOR IS ACTIVE, AND THE TIME BASE IS NONZER
                      ; THEN THE UPDATE COORDINATE ROUTINE IS CALLED FOR THE X
                      ; AND Y PORTIONS OF THE PACKET.
0633 FDCB08F6         MVECT:  SET  PSWZRO,(IY+CBFLAG) ; SET ZERO FLAG
0637 DDCB017E                 BIT  VBSACT,(IX+VBSTAT) ; IS VECTOR ACTIVE?
063B DD4E02                   LD   C,(IX+VBTIMB) ; TIME BASE TO C
063E DD360200                 LD   (IX+VBTIMB),0 ; ZERO TIME BASE
0642 FD7106                   LD   (IY+CBC),C    ; PASS BACK TIME BASE
0645 C8                       RET  Z
0646 79                       LD   A,C
0647 A7                       AND  A             ; IS TIME BASE ZERO?
0648 C8                       RET  Z             ; QUIT IF SO
0649 110300                   LD   DE,VBDXL      ; ADVANCE TO FIRST
064C DD19                     ADD  IX,DE
064E CD5606                   CALL MVECTC        ; UPDATE FIRST COORDINATE
0651 110500                   LD   DE,VBDYL-VBDXL ; TO Y
0654 DD19                     ADD  IX,DE
                      ; AND FALL INTO ...
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

               2043   ; NAME:          VECTOR COORDINATE
               2044   ; PURPOSE:       UPDATE OF SINGLE COORDINATE
               2045   ; INPUT:         IX = POINTER TO L.O. DELTA BYTE OF VECTOR
               2046   ;                C = TIME BASE
               2047   ;                HL = LIMITS PACKET (IF USED)
               2048   ; OUTPUT:        NONZERO STATUS SET IF MOTION OCCURED
               2049   ;                (SHOULD BE SET ON CALL, SINCE IT IS NOT S
               2050   ; NOTES:
               2051   ;   THIS ROUTINE OPERATES ON A SUBSET OF THE VECTOR PACK
               2052   ; (BETWEEN L.O. DELTA BYTE AND CHECKS BYTE).
               2053   ;   THE DELTA IS ADDED TO THE COORDINATE TIME-BASE TIMES
               2054   ; IF OPTIONED, LIMIT CHECKING IS DONE.  IF THE CHECK FAI
               2055   ; THE COORDINATE IS SET TO THE LIMIT.
               2056   ; WHEN THIS HAPPENS, THE LIMIT ATTAINED BIT IS SET
0656 E5        2057  MVECTC: PUSH HL
0657 DD5601    2058          LD   D,(IX+VBDCH) ; LOAD DELTA
065A DD5E00    2059          LD   E,(IX+VBDCL)
065D DD6603    2060          LD   H,(IX+VBCH)  ; LOAD COORDINATE
0660 DD6E02    2061          LD   L,(IX+VBCL)
0663 7C        2062          LD   A,H          ; SAVE OLD COORDINATE FOR MOTIO
0664 41        2063          LD   B,C
0665 19        2064  MVECT1: ADD  HL,DE        ; ADD DELTA TO COORD
0666 10FD      2065          DJNZ MVECT1-$     ; TIME-BASE TIMES
               2066    ; HAS MOTION OCCURED?
0668 BC        2067          CP   H
0669 2804      2068          JR   Z,MVCT1A-$   ; JUMP TO SKIP TESTS IF SO
066B FDCB08B6  2069          RES  PSWZRO,(IY+CBFLAG) ; SET MOVED STATUS
               2070    ; IS LIMIT CHECK WANTED?
066F DDCB0446  2071  MVCT1A: BIT  VBCLMT,(IX+VBCCHK)
0673 2831      2072          JR   Z,MVECT6-$   ; MVECT6 IF NOT
               2073    ; PERFORM LIMIT CHECK
0675 7C        2074          LD   A,H
0676 E3        2075          EX   (SP),HL
0677 46        2076          LD   B,(HL)       ; LIMIT TO B
0678 23        2077          INC  HL
               2078  ; HANDLE SLIGHTLY LESS THAN ZERO CASE
0679 FECF      2079          CP   207          ; MIDPOINT BETWEEN 160 AND 0
067B 3007      2080          JR   NC,MVECT2-$  ; JUMP TO FAIL IF >207
067D B8        2081          CP   B            ; DO COMPARE
067E 3804      2082          JR   C,MVECT2-$   ; JUMP ON FAIL
0680 46        2083          LD   B,(HL)       ; UPPER LIMIT CHECK
0681 B8        2084          CP   B
0682 3820      2085          JR   C,MVECT3-$   ; JUMP ON PASS
0684 23        2086  MVECT2: INC  HL
               2087  ; A LIMIT WAS EXCEEDED - SET COORDINATE AT LIMIT
0685 DD7003    2088          LD   (IX+VBCH),B
0688 DD360200  2089          LD   (IX+VBCL),0
068C DDCB04DE  2090          SET  VBCLAT,(IX+VBCCHK) ; SET LIMIT ATTAINED
               2091  ; IS REVERSE DELTA OPTION SET?
0690 F1        2092          POP  AF           ; CLEAN UP STACK
0691 DDCB044E  2093          BIT  VBCREV,(IX+VBCCHK)
0695 C8        2094          RET  Z            ; QUIT IF NOT
               2095  ; REVERSE THE BIMBO
0696 7A        2096          LD   A,D
0697 2F        2097          CPL
0698 57        2098          LD   D,A
0699 7B        2099          LD   A,E
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

069A 2F       2100          CPL
069B 5F       2101          LD   E,A
069C 13       2102          INC  DE
069D DD7300   2103          LD   (IX+VBDCL),E ; STORE BACK
06A0 DD7201   2104          LD   (IX+VBDCH),D
06A3 C9       2105          RET
06A4 23       2106  MVECT3: INC  HL             ; STEP PAST LIMIT
06A5 E3       2107          EX   (SP),HL        ; HL = COORDINATE AGAIN
06A6 DD7502   2108  MVECT6: LD   (IX+VBCL),L    ; STORE BACK COORDINATES
06A9 DD7403   2109          LD   (IX+VBCH),H
06AC E1       2110          POP  HL             ; RESTORE LIMITS POINTER
06AD DDCB049E 2111          RES  VBCLAT,(IX+VBCCHK) ; CLEAR ATTAINED BIT
06B1 C9       2112          RET
```

```
ADDR OBJECT   STMT  LABEL    OPCD OPERAND       COMMENT

              2114  ; ***************************
              2115  ; * PAINT RECTANGLE ROUTINE *
              2116  ; ***************************
              2117  ; NAME:            PAINT RECTANGLE
              2118  ; INPUT:           A = COLOR MASK TO WRITE
              2119  ;                  B = Y SIZE
              2120  ;                  C = X SIZE
              2121  ;                  D = Y COORDINATE
              2122  ;                  E = X COORDINATE
06B2 AF       2123  MPAINT:  XOR  A
06B3 CD4E0B   2124           CALL RELTA1
06B6 EB       2125           EX   DE,HL
06B7 CBF4     2126           SET  6,H          ; UNMAGIC THE ADDRESS
06B9 D30C     2127           OUT  (MAGIC),A
              2128  ;        XOR     A
06BB FD5E09   2129           LD   E,(IY+CBA)
06BE 79       2130           LD   A,C
06BF 0F       2131           RRCA
06C0 0F       2132           RRCA
06C1 E63F     2133           AND  3FH
06C3 3C       2134           INC  A
06C4 57       2135           LD   D,A
06C5 15       2136  MPT1:    DEC  D
06C6 2807     2137           JR   Z,MPT2-$
06C8 3EFF     2138           LD   A,0FFH
06CA CDE206   2139           CALL STRIPE
06CD 18F6     2140           JR   MPT1-$
06CF 79       2141  MPT2:    LD   A,C
06D0 E603     2142           AND  03H
06D2 3C       2143           INC  A
06D3 4F       2144           LD   C,A
06D4 AF       2145           XOR  A
06D5 0D       2146  MPT3:    DEC  C
06D6 2806     2147           JR   Z,MPT4-$
06D8 0F       2148           RRCA
06D9 0F       2149           RRCA
06DA C6C0     2150           ADD  A,11000000B
06DC 18F7     2151           JR   MPT3-$
06DE CDE206   2152  MPT4:    CALL STRIPE
06E1 AF       2153           XOR  A
              2154  ; AND FALL INTO ...
              2155  ; STRIPE PAINTER
              2156  ; HL = ADDRESS OF STRIPE A = DATA E =MASK B = ITERATIONS
              2157  ; OUT HL=HL+1 A = CLOBBERED
06E2 E5       2158  STRIPE:  PUSH HL
06E3 C5       2159           PUSH BC
06E4 32FF0F   2160           LD   (WASTE),A
06E7 3AFF4F   2161           LD   A,(WASTE+4000H)
06EA 4F       2162           LD   C,A
06EB 7B       2163  STRP1:   LD   A,E
06EC AE       2164           XOR  (HL)
06ED A1       2165           AND  C
06EE AE       2166           XOR  (HL)
06EF 77       2167           LD   (HL),A
06F0 7D       2168           LD   A,L
06F1 C628     2169           ADD  A,BYTEPL
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

06F3 6F        2170           LD   L,A
06F4 7C        2171           LD   A,H
06F5 CE00      2172           ADC  A,0
06F7 67        2173           LD   H,A
06F8 10F1      2174           DJNZ STRP1-$
06FA C1        2175           POP  BC
06FB E1        2176           POP  HL
06FC 23        2177           INC  HL
06FD C9        2178           RET
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND       COMMENT

              2180   ; ******************
              2181   ; * WRITE ROUTINES *
              2182   ; ******************
              2183   ; NOTES:          THE GENERAL CALLING SEQUENCE FOR THE WRI
              2184   ; INPUT:          HL = PATTERN ADDRESS
              2185   ;                 D = Y COORDINATE
              2186   ;                 E = X COORDINATE
              2187   ;                 B = Y SIZE
              2188   ;                 C = X SIZE
              2189   ;                 A = MAGIC REGISTER
              2190   ; OUTPUT:         DE = SCREEN ADDRESS USED
              2191   ;                   THESE ROUTINES ARE NESTED, FOR EXAMPLE
              2192   ;                 WRITP, WHICH FALLS INTO WRIT, WHICH FALL
              2193   ; ENTRY:          WRITE FROM VECTOR
              2194   ; INPUT:          HL = PATTERN ADDRESS
              2195   ;                 IX = VECTOR ADDRESS
              2196   ; OUTPUT:         DE, A
              2197   ; SIDE EFFECTS:   BLANK BIT SET IN VECTOR STATUS BYTE
06FE DD7E00   2198  MVWRIT: LD   A,(IX+VBMR)   ; LOAD MR
0701 DD560B   2199          LD   D,(IX+VBYH)   ; LOAD Y
0704 DD5E06   2200          LD   E,(IX+VBXH)   ; LOAD X
0707 DDCB01F6 2201          SET  VBBLNK,(IX+VBSTAT) ; SET BLANK BIT
              2202   ; ENTRY:          WRITE RELATIVE
              2203   ; PURPOSE:        WRITING RELATIVE PATTERNS
              2204   ; INPUT:          HL,DE,A
              2205   ; OUTPUT:         DE
              2206   ; NOTES:          PATTERN IS PRECEEDED BY RELATIVE DISPLAC
              2207   ;                 (X FIRST, THEN Y) AND PATTERN SIZE
070B F5       2208  MWRITR: PUSH AF             ; SAVE MR
070C 7E       2209          LD   A,(HL)        ; GET REL X
070D 23       2210          INC  HL
070E 83       2211          ADD  A,E           ; ADD TO SUPERIOR X
070F 5F       2212          LD   E,A
0710 7E       2213          LD   A,(HL)        ; SAME STORY FOR Y
0711 23       2214          INC  HL
0712 82       2215          ADD  A,D
0713 57       2216          LD   D,A
0714 F1       2217          POP  AF
              2218   ; ENTRY:          WRITE WITH PATTERN SIZE SCARE-UP
              2219   ; PURPOSE:        WRITING VARIABLE SIZED PATTERNS
              2220   ; INPUT:          HL,DE,A
              2221   ; OUTPUT:         DE
              2222   ; NOTES:          FIRST TWO BYTES POINTED AT BY HL ARE TAK
              2223   ;                 TO BE PATTERN SIZES (X SIZE FIRST)
0715 4E       2224  MWRITP: LD   C,(HL)        ; GET X SIZE
0716 23       2225          INC  HL
0717 46       2226          LD   B,(HL)        ; AND Y
0718 23       2227          INC  HL
              2228   ; ENTRY:          WRITE WITH COORDINATE CONVERSION
              2229   ; INPUT:          HL,DE,BC,A
              2230   ; OUTPUT:         DE
0719 CDF60A   2231  MWRIT:  CALL MRELAB        ; DO CONVERSION
              2232   ; ENTRY:          WRITE ABSOLUTE
              2233   ; INPUT:          HL,BC,A AS ABOVE
              2234   ;                 DE = ABSOLUTE SCREEN ADDRESS
071C CB77     2235  MWRITA: BIT  MRFLOP,A      ; FLOP WRITE WANTED?
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

071E 202C      2236           JR   NZ,MWRTFL-$   ; MWRTFL IF SO
0720 CB5F      2237           BIT  MRXPND,A      ; EXPAND WANTED?
0722 2011      2238           JR   NZ,MWX-$      ; JUMP IF SO
               2239    ; DO NORMAL? WRITE
0724 AF        2240           XOR  A
0725 C5        2241  MWRT:    PUSH BC
0726 D5        2242           PUSH DE
0727 47        2243           LD   B,A          ; ZERO REGISTER B
0728 EDB0      2244           LDIR              ; WRITE A LINE
072A 12        2245           LD   (DE),A       ; CLEAR THE SHIFTER
072B D1        2246           POP  DE
072C EB        2247           EX   DE,HL        ; ADVANCE TO NEXT LINE
072D 0E28      2248           LD   C,BYTEPL
072F 09        2249           ADD  HL,BC
0730 EB        2250           EX   DE,HL
0731 C1        2251           POP  BC
0732 10F1      2252           DJNZ MWRT-$       ; LOOP IF MORE GOODIES
0734 C9        2253           RET
               2254  ; WRITE EXPANDED
0735 EB        2255  MWX:     EX   DE,HL
0736 C5        2256  MWX1:    PUSH BC
0737 E5        2257           PUSH HL
0738 41        2258           LD   B,C
0739 1A        2259  MWX2:    LD   A,(DE)
073A 13        2260           INC  DE
073B 77        2261           LD   (HL),A
073C 23        2262           INC  HL
073D 77        2263           LD   (HL),A
073E 23        2264           INC  HL
073F 10F8      2265           DJNZ MWX2-$
0741 70        2266           LD   (HL),B
0742 23        2267           INC  HL
0743 70        2268           LD   (HL),B
0744 E1        2269           POP  HL
0745 0E28      2270           LD   C,BYTEPL
0747 09        2271           ADD  HL,BC
0748 C1        2272           POP  BC
0749 10EB      2273           DJNZ MWX1-$
074B C9        2274           RET
               2275    ; ROUTINE TO HANDLE FLOPPED CASE
074C CB5F      2276  MWRTFL:  BIT  MRXPND,A      ; EXPANDED FLOPPED WRITE WANTED
074E 2016      2277           JR   NZ,MWXF-$     ; JUMP IF YEP
0750 AF        2278           XOR  A
0751 C5        2279  WRFL1:   PUSH BC
0752 D5        2280           PUSH DE
0753 47        2281           LD   B,A
0754 EDA0      2282  WRFL2:   LDI
0756 1B        2283           DEC  DE
0757 1B        2284           DEC  DE
0758 EA5407    2285           JP   PE,WRFL2
075B 12        2286           LD   (DE),A       ;
075C D1        2287           POP  DE
075D EB        2288           EX   DE,HL        ; SAME AS NORMAL NOW ON
075E 0E28      2289           LD   C,BYTEPL
0760 09        2290           ADD  HL,BC
0761 EB        2291           EX   DE,HL
0762 C1        2292           POP  BC
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

0763 10EC      2293           DJNZ WRFL1-$
0765 C9        2294           RET
               2295  ; WRITE EXPANDED FLOPPED ROUTINE
0766 EB        2296  MWXF:    EX   DE,HL
0767 C5        2297  MWXF1:   PUSH BC
0768 E5        2298           PUSH HL
0769 41        2299           LD   B,C
076A 1A        2300  MWXF2:   LD   A,(DE)
076B 13        2301           INC  DE
076C 77        2302           LD   (HL),A
076D 2B        2303           DEC  HL
076E 77        2304           LD   (HL),A
076F 2B        2305           DEC  HL
0770 10F8      2306           DJNZ MWXF2-$
0772 70        2307           LD   (HL),B
0773 2B        2308           DEC  HL
0774 70        2309           LD   (HL),B
0775 E1        2310           POP  HL
0776 0E28      2311           LD   C,BYTEPL
0778 09        2312           ADD  HL,BC
0779 C1        2313           POP  BC
077A 10EB      2314           DJNZ MWXF1-$
077C C9        2315           RET
               2316   ; NAME:          BLANK FROM VECTOR
               2317   ; PURPOSE:       BLANK WITH INFO LOAD FROM VECTOR
               2318   ; INPUT:         IX = VECTOR
               2319   ;                E = X SIZE
               2320   ;                D = Y SIZE
               2321   ; NOTES:         THIS ROUTINE BLANKS TO 00
               2322   ;                THIS ROUTINE INTERROGATES THE BLANK BIT
               2323   ;                AND REFRAINS FROM BLANKING IF NOT SET
               2324   ;                IF IT WAS SET, IT IS THEN RESET
077D DDCB0176  2325  MVBLAN:  BIT  VBBLNK,(IX+VBSTAT) ; IS BLANK BIT SET?
0781 C8        2326           RET  Z                  ; QUIT IF NOT
0782 DDCB01B6  2327           RES  VBBLNK,(IX+VBSTAT) ; KILL BLANK BIT
0786 DD660E    2328           LD   H,(IX+VBOAH) ; LOAD BLANK ADDRESS
0789 DD6E0D    2329           LD   L,(IX+VBOAL)
078C DDCB0076  2330           BIT  MRFLOP,(IX+VBMR) ; IS FLOP SET?
0790 2808      2331           JR   Z,MVBLA1-$      ; JUMP IF NOT
0792 7B        2332           LD   A,E             ; X SIZE TO A
0793 ED44      2333           NEG                  ; TWOS COMPLEMENT AND ADD 1
0795 3C        2334           INC  A
0796 4F        2335           LD   C,A
0797 06FF      2336           LD   B,0FFH
0799 09        2337           ADD  HL,BC           ; USE TO BACK UP SCREEN ADDRESS
               2338  ; UNMAGIC THE BLANK ADDRESS
079A           2339  MVBLA1:
079A CBF4      2340           SET  6,H
079C 0600      2341           LD   B,0             ; ASSUME BLANK TO ZERO
               2342   ; NAME:          BLANK AREA
               2343   ; PURPOSE:       SETTING N X M REGION TO CONSTANT
               2344   ; INPUT:         HL = BLANK ADDRESS
               2345   ;                E = X SIZE
               2346   ;                D = Y SIZE
               2347   ;                B = DATA TO FILL WITH
079E 3E28      2348  MBLANK:  LD   A,BYTEPL        ; COMPUTE LINE INCREMENT
07A0 93        2349           SUB  E
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

07A1 4F        2350           LD   C,A
07A2 78        2351           LD   A,B            ; A = DATA TO FILL WITH
07A3 43        2352  MBLAN1:  LD   B,E
07A4 77        2353  MBLAN2:  LD   (HL),A
07A5 23        2354           INC  HL
07A6 10FC      2355           DJNZ MBLAN2-$
07A8 09        2356           ADD  HL,BC
07A9 15        2357           DEC  D
07AA 20F7      2358           JR   NZ,MBLAN1-$
07AC C9        2359           RET
               2360  ; NAME:         RESTORE AREA
               2361  ; INPUT:        HL = SCREEN ADDRESS TO RESTORE TO
               2362  ;               DE = SAVE AREA ADDRESS
               2363  ; NOTE:         SIZES ARE LOADED FROM THE SAVE AREA
07AD EB        2364  MREST:   EX   DE,HL
07AE 4E        2365           LD   C,(HL)
07AF 23        2366           INC  HL
07B0 46        2367           LD   B,(HL)
07B1 23        2368           INC  HL
07B2 CBF2      2369           SET  6,D            ; MAKE SURE WE ARE NONMAGIC
07B4 AF        2370           XOR  A
07B5 C5        2371  MREST1:  PUSH BC
07B6 D5        2372           PUSH DE
07B7 47        2373           LD   B,A
07B8 EDB0      2374           LDIR
07BA EB        2375           EX   DE,HL
07BB E1        2376           POP  HL
07BC 0E28      2377           LD   C,BYTEPL
07BE 09        2378           ADD  HL,BC
07BF EB        2379           EX   DE,HL
07C0 C1        2380           POP  BC
07C1 10F2      2381           DJNZ MREST1-$
07C3 C9        2382           RET
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

                     ; *******************************
                     ; * CHARACTER DISPLAY ROUTINES *
                     ; *******************************
                     ; NAME:           DISPLAY STRING
                     ; PURPOSE:        MESSAGE DISPLAY
                     ; INPUT:          E,D = X, Y COORDINATES
                     ;                 HL = STRING ADDRESS
                     ;                 IX = FONT DESCRIPTOR
                     ; OUTPUT:         D,E ALTERED AS IN DISPLAY CHARACTER
                     ; STACK USE:      4 BYTES (EXCLUDING USE BY SYSPCH)
                     ; EXPLANATION: AS EACH CHARACTER IS BROUGHT IN, IT
                     ; IS TESTED FOR BEING A LIST TERMINATOR ( CHAR = 0)
                     ; IF IT ISN'T, DISPLAY CHARACTER IS CALLED AND THE
                     ; TEST IS REPEATED FOR THE NEXT CHARACTER.  THUS
                     ; A NULL STRING IS HANDLED PROPERLY.
07C4 7E              STRNEW: LD   A,(HL)          ; GET CHARACTER
07C5 A7                      AND  A               ; BE IT A TERMINATOR?
07C6 C8                      RET  Z               ; QUIT IF SO
07C7 FACE07                  JP   M,STRD1         ; DISPLAY IF ALT FONT
07CA FE64                    CP   64H             ; SUCK IN STRING?
07CC 3006                    JR   NC,STRD2-$      ; JUMP IF YES
07CE CDE107          STRD1:  CALL DISPCH          ; SHOW CHAR
07D1 23                      INC  HL              ; ADVANCE TO NEXT CHAR
07D2 18F0                    JR   STRNEW-$        ; AND LOOP
07D4 E617            STRD2:  AND  10111B          ; MAKE SUCK MASK
07D6 47                      LD   B,A
07D7 23                      INC  HL
07D8 EB                      EX   DE,HL
07D9 CDA800                  CALL MSUCK1
07DC CD6800                  CALL RELD
07DF 18E3                    JR   STRNEW-$        ; GO AFTER NEXT CHARACTER
                     ; ******************************
                     ; * CHARACTER DISPLAY ROUTINE *
                     ; ******************************
                     ; INPUT:          A = CHARACTER
                     ;                 C = OPTIONS
                     ;                 D = Y COORDINATE
                     ;                 E = X COORDINATE
                     ;                 IX = FONT DESCRIPTOR
                     ;                 (ONLY IF ALTERNATE FONT USED)
                     ; OUTPUT:         DE UPDATED TO POINT AT NEXT CHARACTER FRA
                     ; NOTES:          THE OPTION BYTE IS FORMATTED AS FOLLOWS:
                     ;         BITS    CONTENTS
                     ;         ----    --------
                     ;         0-1     OFF COLOR FOR EXPANSION
                     ;         2-3     ON COLOR FOR EXPANSION
                     ;         4       OR OPTION
                     ;         5       XOR OPTION
                     ;         6-7     ENLARGEMENT FACTOR (N+1)X
                     ;
                     ; CHARACTERS BETWEEN 1 AND 1FH, AND BETWEEN 81H AND 9FH
                     ; ARE INTERPRETED AS TAB CHARACTERS.  THEY CAUSE THE
                     ; CURSOR REPRESENTED BY D AND E TO BE SPACED OVER N
                     ; CHARACTER POSITIONS, WHERE N = CHAR. AND. 7FH
                     ; CHARACTERS BETWEEN 20H AND 7FH ARE TAKEN AS REFERENCES
                     ; THE SYSTEM STANDARD 5 X 7 CHARACTER FONT.  CHARACTERS
```

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ADDR OBJECT     LABEL    OPCD OPERAND         COMMENT

                ; BETWEEN 0A0H AND 0FFH REFER TO THE USER SUPPLIED ALTERN
                ; CHARACTER FONT.   THIS FONT IS DESCRIBED BY A FONT
                ; DESCRIPTOR TABLE OF THE FOLLOWING FORMAT:
                ; ******************************
                ; * 0 * BASE CHARACTER VALUE    *
                ; ******************************
                ; * 1 * X FRAME SIZE            *
                ; ******************************
                ; * 2 * Y FRAME SIZE            *
                ; ******************************
                ; * 3 * X PATTERN SIZE (BYTES) *
                ; ******************************
                ; * 4 * Y PATTERN SIZE          *
                ; ******************************
                ; * 5 *   PATTERN TABLE         *
                ; * 6 *      ADDRESS            *
                ; ******************************
07E1 C5         DISPCH: PUSH BC
07E2 E5                 PUSH HL
07E3 DDE5               PUSH IX
07E5 A7                 AND  A
07E6 FAED07             JP   M,DISCH1       ; JUMP IF YES
07E9 DD210602           LD   IX,SYSFNT
07ED FE20       DISCH1: CP   20H            ; IS CHAR < 20H?
07EF 300D               JR   NC,DISC1B-$    ; JUMP IF NOT
07F1 F5         DISC1A: PUSH AF             ; LOOP TO SPACE OVER
07F2 CD4E08             CALL NXTFRM
07F5 CDF40C             CALL FINDL3         ; STORE IT BACK
07F8 F1                 POP  AF
07F9 3D                 DEC  A
07FA 20F5               JR   NZ,DISC1A-$
07FC 183B               JR   DISCH5-$       ; JUMP TO EXIT
07FE DD9600     DISC1B: SUB  (IX+FTBASE)    ; SUBTRACT BASE CHAR
0801 5F                 LD   E,A
0802 1600               LD   D,0
0804 210000             LD   HL,0
0807 DD4E03             LD   C,(IX+FTBYTE) ; MULTIPLY CHARACTER
080A DD4604     DISCH2: LD   B,(IX+FTYSIZ) ; BY PATTERN SIZE
080D 19         DISCH3: ADD  HL,DE
080E 10FD               DJNZ DISCH3-$
0810 0D                 DEC  C
0811 20F7               JR   NZ,DISCH2-$
0813 DD5606             LD   D,(IX+FTPTH) ; ADD TO TABLE START
0816 DD5E05             LD   E,(IX+FTPTL)
0819 19                 ADD  HL,DE
                ; COMPUTE POSITION WHERE NEXT CHARACTER WOULD GO
                ; AND SAVE
081A CD4E08             CALL NXTFRM         ; STEP COORDINATES TO NEXT FRAM
081D D5                 PUSH DE             ; SAVE
081E DD4604             LD   B,(IX+FTYSIZ)
0821 C5         DISCH4: PUSH BC
0822 E5                 PUSH HL
0823 CD6C08             CALL WRTLIN
0826 E1                 POP  HL
0827 DD4E03             LD   C,(IX+FTBYTE) ; STEP TO NEXT LINE OF PATTERN
082A 09                 ADD  HL,BC
082B C1                 POP  BC
```

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ADDR OBJECT   STMT  LABEL    OPCD OPERAND        COMMENT

082C FD7E05   2497           LD   A,(IY+CBD)    ; ADVANCE Y COORDINATE
082F 81       2498           ADD  A,C
0830 FD7705   2499           LD   (IY+CBD),A
0833 10EC     2500           DJNZ DISCH4-$
0835 D1       2501           POP  DE             ; RESTORE NEW POSITION
0836 CDF40C   2502           CALL FINDL3         ; STUFF DE BACK INTO CONTEXT
0839 DDE1     2503  DISCH5:  POP  IX
083B E1       2504           POP  HL
083C C1       2505           POP  BC
083D C9       2506           RET
              2507  ; SUBROUTINE TO CONVERT ENLARGEMENT FACTOR TO ITERATION C
              2508  ; INPUT:         MODE BYTE FROM CONTEXT SAVE AREA
              2509  ; OUTPUT:        B,A = ITERATION COUNT
083E FD7E06   2510  DCLCTB:  LD   A,(IY+CBC)    ; GET MODE BYTE
0841 07       2511           RLCA
0842 07       2512           RLCA
0843 E603     2513           AND  03             ; ISOLATE ENLARGEMENT FACTOR
0845 3C       2514           INC  A
0846 47       2515           LD   B,A
0847 AF       2516           XOR  A
0848 37       2517           SCF
0849 8F       2518  DCLCT1:  ADC  A,A
084A 10FD     2519           DJNZ DCLCT1-$
084C 47       2520           LD   B,A
084D C9       2521           RET
              2522  ; SUBROUTINE TO UPDATE COORDINATES TO POINT AT NEXT CHARA
              2523  ; FRAME:
              2524  ; INPUT:         COORDINATES TAKEN FROM CBD,CBE IN CONTEXT
              2525  ; OUTPUT:        UPDATED COORDINATES RETURNED IN D AND E
              2526  ;              A,B = CLOBBERED, C=ENLARGE FACTOR CONVERT
084E CD3E08   2527  NXTFRM:  CALL DCLCTB         ; GET ITERATION COUNT
0851 48       2528           LD   C,B            ; SAVE
0852 FD5605   2529           LD   D,(IY+CBD)    ; GET Y COORD
0855 FD7E04   2530           LD   A,(IY+CBE)    ; GET X COORD
0858 DD8601   2531  NXTFR1:  ADD  A,(IX+FTFSX) ; ADD X FRAME SIZE
085B 10FB     2532           DJNZ NXTFR1-$       ; 2**ENLARGE TIMES
085D FEA0     2533           CP   160            ; PAST RIGHT EDGE OF SCREEN?
085F 3809     2534           JR   C,NXTFR3-$
0861 7A       2535           LD   A,D
0862 41       2536           LD   B,C
0863 DD8602   2537  NXTFR2:  ADD  A,(IX+FTFSY) ; YEP - ADVANCE VERTICAL
0866 10FB     2538           DJNZ NXTFR2-$
0868 57       2539           LD   D,A
0869 AF       2540           XOR  A
086A 5F       2541  NXTFR3:  LD   E,A
086B C9       2542           RET
              2543  ; SUBROUTINE TO WRITE ONE LINE OF A PATTERN WITH ENLARGE
              2544  ; AND EXPAND
              2545  ; ENTRY: HL = SOURCE  IX = FONT TABLE
086C DD4E03   2546  WRTLIN:  LD   C,(IX+FTBYTE)
086F 0600     2547           LD   B,0
0871 DDE5     2548           PUSH IX             ; CAPTURE STACK POINTER
0873 DD210000 2549           LD   IX,0
0877 DD39     2550           ADD  IX,SP
0879 DDE5     2551           PUSH IX             ; SAVE CAPTURED STACK
087B D1       2552           POP  DE             ; DE = CAPTURED STACK
087C 3E0C     2553           LD   A,0CH          ; SET EXPAND TO 00,11
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

087E D319      2554           OUT  (XPAND),A
0880 3E08      2555           LD   A,08H          ; SET EXPAND BIT
0882 D30C      2556           OUT  (MAGIC),A
0884 FD7E06    2557           LD   A,(IY+CBC)     ; GET CONTROL BYTE
0887 E6C0      2558           AND  0C0H           ; ISOLATE ENLARGE AMOUNT
0889 2821      2559           JR   Z,WRTL3-$      ; JUMP IF ZERO
088B 07        2560           RLCA
088C 07        2561           RLCA
088D EB        2562  WRTL1:   EX   DE,HL
088E A7        2563           AND  A              ; CLEAR CARRY BIT
088F ED42      2564           SBC  HL,BC          ; COMPUTE STACK FRAME SIZE
0891 ED42      2565           SBC  HL,BC
0893 F9        2566           LD   SP,HL          ; SEIZE STACK SPACE
0894 CBB4      2567           RES  6,H            ; MAGICIFY THE ADDRESS
0896 F5        2568           PUSH AF
0897 41        2569           LD   B,C
0898 1A        2570  WRTL2:   LD   A,(DE)         ; GET SOURCE BYTE
0899 13        2571           INC  DE
089A 77        2572           LD   (HL),A         ; EXPAND IT
089B 23        2573           INC  HL
089C 77        2574           LD   (HL),A         ;
089D 23        2575           INC  HL
089E 10F8      2576           DJNZ WRTL2-$
08A0 CB21      2577           SLA  C
08A2 F1        2578           POP  AF
08A3 210000    2579           LD   HL,0           ; CAPTURE STACK TOP AGAIN
08A6 39        2580           ADD  HL,SP
08A7 54        2581           LD   D,H            ; SET DE=HL
08A8 5D        2582           LD   E,L            ; FOR NEXT DEST COMBO
08A9 3D        2583           DEC  A
08AA 20E1      2584           JR   NZ,WRTL1-$
               2585  ; NOW DO WRITE TO SCREEN
08AC CD3E08    2586  WRTL3:   CALL DCLCTB         ; GET ITERATION COUNTER
08AF CD7400    2587           CALL DELOAD
08B2 FD7E06    2588           LD   A,(IY+CBC)
08B5 D319      2589           OUT  (XPAND),A
08B7 E630      2590           AND  030H
08B9 F608      2591           OR   8
08BB CD080B    2592           CALL RELTA
08BE EB        2593           EX   DE,HL
08BF F5        2594  WRTL4:   PUSH AF
08C0 C5        2595           PUSH BC
08C1 D5        2596           PUSH DE
08C2 E5        2597           PUSH HL
08C3 41        2598           LD   B,C
08C4 1A        2599  WRTL5:   LD   A,(DE)
08C5 13        2600           INC  DE
08C6 77        2601           LD   (HL),A
08C7 23        2602           INC  HL
08C8 77        2603           LD   (HL),A
08C9 23        2604           INC  HL
08CA 10F8      2605           DJNZ WRTL5-$
08CC FD7E04    2606           LD   A,(IY+CBE)     ;
08CF E603      2607           AND  03
08D1 2801      2608           JR   Z,WRTL6-$      ;
08D3 70        2609           LD   (HL),B
08D4 E1        2610  WRTL6:   POP  HL             ; STEP TO NEXT LINE
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

08D5 0E28      2611           LD   C,BYTEPL
08D7 09        2612           ADD  HL,BC
08D8 D1        2613           POP  DE
08D9 C1        2614           POP  BC
08DA F1        2615           POP  AF
08DB D30C      2616           OUT  (MAGIC),A
08DD 10E0      2617           DJNZ WRTL4-$
08DF DDF9      2618           LD   SP,IX          ; RESTORE STACK
08E1 DDE1      2619           POP  IX
08E3 C9        2620           RET

               2622    ; MACRO TO GENERATE CHARACTER PATTERN TABLE ENTRY
               2623  DEFCHR   MACR #A,#B,#C,#D,#E,#F,#G
               2624           DEFB #A
               2625           DEFB #B
               2626           DEFB #C
               2627           DEFB #D
               2628           DEFB #E
               2629           DEFB #F
               2630           DEFB #G
               2631           ENDM

               2633   ; LARGE CHARACTER SET (8 X 8)
08E4           2634  LRGCHR
08E4           2635           DEFCHR 000H,000H,000H,000H,000H,000H,000H ;  SPACE
08E4 00        2635 +         DEFB 000H
08E5 00        2635 +         DEFB 000H
08E6 00        2635 +         DEFB 000H
08E7 00        2635 +         DEFB 000H
08E8 00        2635 +         DEFB 000H
08E9 00        2635 +         DEFB 000H
08EA 00        2635 +         DEFB 000H
08EB           2636           DEFCHR 020H,020H,020H,020H,020H,000H,020H ;  !
08EB 20        2636 +         DEFB 020H
08EC 20        2636 +         DEFB 020H
08ED 20        2636 +         DEFB 020H
08EE 20        2636 +         DEFB 020H
08EF 20        2636 +         DEFB 020H
08F0 00        2636 +         DEFB 000H
08F1 20        2636 +         DEFB 020H
08F2           2637           DEFCHR 050H,050H,050H,000H,000H,000H,000H ;  "
08F2 50        2637 +         DEFB 050H
08F3 50        2637 +         DEFB 050H
08F4 50        2637 +         DEFB 050H
08F5 00        2637 +         DEFB 000H
08F6 00        2637 +         DEFB 000H
08F7 00        2637 +         DEFB 000H
08F8 00        2637 +         DEFB 000H
08F9           2638           DEFCHR 048H,048H,0FCH,048H,0FCH,048H,048H ;  #
08F9 48        2638 +         DEFB 048H
08FA 48        2638 +         DEFB 048H
08FB FC        2638 +         DEFB 0FCH
08FC 48        2638 +         DEFB 048H
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ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

08FD FC       2638 +        DEFB 0FCH
08FE 48       2638 +        DEFB 048H
08FF 48       2638 +        DEFB 048H
0900          2639          DEFCHR 020H,078H,080H,070H,008H,0F0H,020H ;  $
0900 20       2639 +        DEFB 020H
0901 78       2639 +        DEFB 078H
0902 80       2639 +        DEFB 080H
0903 70       2639 +        DEFB 070H
0904 08       2639 +        DEFB 008H
0905 F0       2639 +        DEFB 0F0H
0906 20       2639 +        DEFB 020H
0907          2640          DEFCHR 0C0H,0C8H,010H,020H,040H,098H,018H ;  %
0907 C0       2640 +        DEFB 0C0H
0908 C8       2640 +        DEFB 0C8H
0909 10       2640 +        DEFB 010H
090A 20       2640 +        DEFB 020H
090B 40       2640 +        DEFB 040H
090C 98       2640 +        DEFB 098H
090D 18       2640 +        DEFB 018H
090E          2641          DEFCHR 060H,090H,0A0H,040H,0A8H,090H,068H ;  &
090E 60       2641 +        DEFB 060H
090F 90       2641 +        DEFB 090H
0910 A0       2641 +        DEFB 0A0H
0911 40       2641 +        DEFB 040H
0912 A8       2641 +        DEFB 0A8H
0913 90       2641 +        DEFB 090H
0914 68       2641 +        DEFB 068H
0915          2642          DEFCHR 060H,060H,060H,000H,000H,000H,000H ;  '
0915 60       2642 +        DEFB 060H
0916 60       2642 +        DEFB 060H
0917 60       2642 +        DEFB 060H
0918 00       2642 +        DEFB 000H
0919 00       2642 +        DEFB 000H
091A 00       2642 +        DEFB 000H
091B 00       2642 +        DEFB 000H
091C          2643          DEFCHR 010H,020H,020H,020H,020H,020H,010H ;  (
091C 10       2643 +        DEFB 010H
091D 20       2643 +        DEFB 020H
091E 20       2643 +        DEFB 020H
091F 20       2643 +        DEFB 020H
0920 20       2643 +        DEFB 020H
0921 20       2643 +        DEFB 020H
0922 10       2643 +        DEFB 010H
0923          2644          DEFCHR 040H,020H,020H,020H,020H,020H,040H ;  )
0923 40       2644 +        DEFB 040H
0924 20       2644 +        DEFB 020H
0925 20       2644 +        DEFB 020H
0926 20       2644 +        DEFB 020H
0927 20       2644 +        DEFB 020H
0928 20       2644 +        DEFB 020H
0929 40       2644 +        DEFB 040H
092A          2645          DEFCHR 000H,0A8H,070H,0D8H,070H,0A8H,000H ;  *
092A 00       2645 +        DEFB 000H
092B A8       2645 +        DEFB 0A8H
092C 70       2645 +        DEFB 070H
092D D8       2645 +        DEFB 0D8H
092E 70       2645 +        DEFB 070H
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

092F A8        2645 +         DEFB 0A8H
0930 00        2645 +         DEFB 000H
0931           2646           DEFCHR 000H,020H,020H,0F8H,020H,020H,000H ;  +
0931 00        2646 +         DEFB 000H
0932 20        2646 +         DEFB 020H
0933 20        2646 +         DEFB 020H
0934 F8        2646 +         DEFB 0F8H
0935 20        2646 +         DEFB 020H
0936 20        2646 +         DEFB 020H
0937 00        2646 +         DEFB 000H
0938           2647           DEFCHR 000H,000H,000H,060H,060H,020H,040H ;  ,
0938 00        2647 +         DEFB 000H
0939 00        2647 +         DEFB 000H
093A 00        2647 +         DEFB 000H
093B 60        2647 +         DEFB 060H
093C 60        2647 +         DEFB 060H
093D 20        2647 +         DEFB 020H
093E 40        2647 +         DEFB 040H
093F           2648           DEFCHR 000H,000H,000H,0F8H,000H,000H,000H ;  -
093F 00        2648 +         DEFB 000H
0940 00        2648 +         DEFB 000H
0941 00        2648 +         DEFB 000H
0942 F8        2648 +         DEFB 0F8H
0943 00        2648 +         DEFB 000H
0944 00        2648 +         DEFB 000H
0945 00        2648 +         DEFB 000H
0946           2649           DEFCHR 000H,000H,000H,000H,000H,060H,060H ;  .
0946 00        2649 +         DEFB 000H
0947 00        2649 +         DEFB 000H
0948 00        2649 +         DEFB 000H
0949 00        2649 +         DEFB 000H
094A 00        2649 +         DEFB 000H
094B 60        2649 +         DEFB 060H
094C 60        2649 +         DEFB 060H
094D           2650           DEFCHR 000H,008H,010H,020H,040H,080H,000H ;
094D 00        2650 +         DEFB 000H
094E 08        2650 +         DEFB 008H
094F 10        2650 +         DEFB 010H
0950 20        2650 +         DEFB 020H
0951 40        2650 +         DEFB 040H
0952 80        2650 +         DEFB 080H
0953 00        2650 +         DEFB 000H
0954           2651           DEFCHR 070H,088H,088H,088H,088H,088H,070H ;  0
0954 70        2651 +         DEFB 070H
0955 88        2651 +         DEFB 088H
0956 88        2651 +         DEFB 088H
0957 88        2651 +         DEFB 088H
0958 88        2651 +         DEFB 088H
0959 88        2651 +         DEFB 088H
095A 70        2651 +         DEFB 070H
095B           2652           DEFCHR 020H,060H,020H,020H,020H,020H,070H ;  1
095B 20        2652 +         DEFB 020H
095C 60        2652 +         DEFB 060H
095D 20        2652 +         DEFB 020H
095E 20        2652 +         DEFB 020H
095F 20        2652 +         DEFB 020H
0960 20        2652 +         DEFB 020H
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND         COMMENT

0961 70        2652 +         DEFB 070H
0962           2653           DEFCHR 070H,088H,008H,070H,080H,080H,0F8H ; 2
0962 70        2653 +         DEFB 070H
0963 88        2653 +         DEFB 088H
0964 08        2653 +         DEFB 008H
0965 70        2653 +         DEFB 070H
0966 80        2653 +         DEFB 080H
0967 80        2653 +         DEFB 080H
0968 F8        2653 +         DEFB 0F8H
0969           2654           DEFCHR 070H,088H,008H,030H,008H,088H,070H ; 3
0969 70        2654 +         DEFB 070H
096A 88        2654 +         DEFB 088H
096B 08        2654 +         DEFB 008H
096C 30        2654 +         DEFB 030H
096D 08        2654 +         DEFB 008H
096E 88        2654 +         DEFB 088H
096F 70        2654 +         DEFB 070H
0970           2655           DEFCHR 010H,030H,050H,090H,0F8H,010H,010H ; 4
0970 10        2655 +         DEFB 010H
0971 30        2655 +         DEFB 030H
0972 50        2655 +         DEFB 050H
0973 90        2655 +         DEFB 090H
0974 F8        2655 +         DEFB 0F8H
0975 10        2655 +         DEFB 010H
0976 10        2655 +         DEFB 010H
0977           2656           DEFCHR 0F8H,080H,0F0H,008H,008H,088H,070H ; 5
0977 F8        2656 +         DEFB 0F8H
0978 80        2656 +         DEFB 080H
0979 F0        2656 +         DEFB 0F0H
097A 08        2656 +         DEFB 008H
097B 08        2656 +         DEFB 008H
097C 88        2656 +         DEFB 088H
097D 70        2656 +         DEFB 070H
097E           2657           DEFCHR 030H,040H,080H,0F0H,088H,088H,070H ; 6
097E 30        2657 +         DEFB 030H
097F 40        2657 +         DEFB 040H
0980 80        2657 +         DEFB 080H
0981 F0        2657 +         DEFB 0F0H
0982 88        2657 +         DEFB 088H
0983 88        2657 +         DEFB 088H
0984 70        2657 +         DEFB 070H
0985           2658           DEFCHR 0F8H,008H,010H,020H,040H,040H,040H ; 7
0985 F8        2658 +         DEFB 0F8H
0986 08        2658 +         DEFB 008H
0987 10        2658 +         DEFB 010H
0988 20        2658 +         DEFB 020H
0989 40        2658 +         DEFB 040H
098A 40        2658 +         DEFB 040H
098B 40        2658 +         DEFB 040H
098C           2659           DEFCHR 070H,088H,088H,070H,088H,088H,070H ; 8
098C 70        2659 +         DEFB 070H
098D 88        2659 +         DEFB 088H
098E 88        2659 +         DEFB 088H
098F 70        2659 +         DEFB 070H
0990 88        2659 +         DEFB 088H
0991 88        2659 +         DEFB 088H
0992 70        2659 +         DEFB 070H
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

0993           2660           DEFCHR 070H,088H,088H,078H,008H,010H,060H ;  9
0993 70        2660 +         DEFB 070H
0994 88        2660 +         DEFB 088H
0995 88        2660 +         DEFB 088H
0996 78        2660 +         DEFB 078H
0997 08        2660 +         DEFB 008H
0998 10        2660 +         DEFB 010H
0999 60        2660 +         DEFB 060H
099A           2661           DEFCHR 000H,060H,060H,000H,060H,060H,000H ;  :
099A 00        2661 +         DEFB 000H
099B 60        2661 +         DEFB 060H
099C 60        2661 +         DEFB 060H
099D 00        2661 +         DEFB 000H
099E 60        2661 +         DEFB 060H
099F 60        2661 +         DEFB 060H
09A0 00        2661 +         DEFB 000H
09A1           2662           DEFCHR 060H,060H,000H,060H,060H,020H,040H ;  ;
09A1 60        2662 +         DEFB 060H
09A2 60        2662 +         DEFB 060H
09A3 00        2662 +         DEFB 000H
09A4 60        2662 +         DEFB 060H
09A5 60        2662 +         DEFB 060H
09A6 20        2662 +         DEFB 020H
09A7 40        2662 +         DEFB 040H
09A8           2663           DEFCHR 010H,020H,040H,080H,040H,020H,010H ;  <
09A8 10        2663 +         DEFB 010H
09A9 20        2663 +         DEFB 020H
09AA 40        2663 +         DEFB 040H
09AB 80        2663 +         DEFB 080H
09AC 40        2663 +         DEFB 040H
09AD 20        2663 +         DEFB 020H
09AE 10        2663 +         DEFB 010H
09AF           2664           DEFCHR 000H,000H,0F8H,000H,0F8H,000H,000H ;  =
09AF 00        2664 +         DEFB 000H
09B0 00        2664 +         DEFB 000H
09B1 F8        2664 +         DEFB 0F8H
09B2 00        2664 +         DEFB 000H
09B3 F8        2664 +         DEFB 0F8H
09B4 00        2664 +         DEFB 000H
09B5 00        2664 +         DEFB 000H
09B6           2665           DEFCHR 040H,020H,010H,008H,010H,020H,040H ;  >
09B6 40        2665 +         DEFB 040H
09B7 20        2665 +         DEFB 020H
09B8 10        2665 +         DEFB 010H
09B9 08        2665 +         DEFB 008H
09BA 10        2665 +         DEFB 010H
09BB 20        2665 +         DEFB 020H
09BC 40        2665 +         DEFB 040H
09BD           2666           DEFCHR 070H,088H,008H,010H,020H,000H,020H ;  ?
09BD 70        2666 +         DEFB 070H
09BE 88        2666 +         DEFB 088H
09BF 08        2666 +         DEFB 008H
09C0 10        2666 +         DEFB 010H
09C1 20        2666 +         DEFB 020H
09C2 00        2666 +         DEFB 000H
09C3 20        2666 +         DEFB 020H
09C4           2667           DEFCHR 070H,088H,0B8H,0A8H,0B8H,080H,078H ;  @
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

09C4 70       2667 +        DEFB 070H
09C5 88       2667 +        DEFB 088H
09C6 B8       2667 +        DEFB 0B8H
09C7 A8       2667 +        DEFB 0A8H
09C8 B8       2667 +        DEFB 0B8H
09C9 80       2667 +        DEFB 080H
09CA 78       2667 +        DEFB 078H
09CB          2668          DEFCHR 070H,088H,088H,0F8H,088H,088H,088H ;  A
09CB 70       2668 +        DEFB 070H
09CC 88       2668 +        DEFB 088H
09CD 88       2668 +        DEFB 088H
09CE F8       2668 +        DEFB 0F8H
09CF 88       2668 +        DEFB 088H
09D0 88       2668 +        DEFB 088H
09D1 88       2668 +        DEFB 088H
09D2          2669          DEFCHR 0F0H,088H,088H,0F0H,088H,088H,0F0H ;  B
09D2 F0       2669 +        DEFB 0F0H
09D3 88       2669 +        DEFB 088H
09D4 88       2669 +        DEFB 088H
09D5 F0       2669 +        DEFB 0F0H
09D6 88       2669 +        DEFB 088H
09D7 88       2669 +        DEFB 088H
09D8 F0       2669 +        DEFB 0F0H
09D9          2670          DEFCHR 070H,088H,080H,080H,080H,088H,070H ;  C
09D9 70       2670 +        DEFB 070H
09DA 88       2670 +        DEFB 088H
09DB 80       2670 +        DEFB 080H
09DC 80       2670 +        DEFB 080H
09DD 80       2670 +        DEFB 080H
09DE 88       2670 +        DEFB 088H
09DF 70       2670 +        DEFB 070H
09E0          2671          DEFCHR 0F0H,088H,088H,088H,088H,088H,0F0H ;  D
09E0 F0       2671 +        DEFB 0F0H
09E1 88       2671 +        DEFB 088H
09E2 88       2671 +        DEFB 088H
09E3 88       2671 +        DEFB 088H
09E4 88       2671 +        DEFB 088H
09E5 88       2671 +        DEFB 088H
09E6 F0       2671 +        DEFB 0F0H
09E7          2672          DEFCHR 0F8H,080H,080H,0E0H,080H,080H,0F8H ;  E
09E7 F8       2672 +        DEFB 0F8H
09E8 80       2672 +        DEFB 080H
09E9 80       2672 +        DEFB 080H
09EA E0       2672 +        DEFB 0E0H
09EB 80       2672 +        DEFB 080H
09EC 80       2672 +        DEFB 080H
09ED F8       2672 +        DEFB 0F8H
09EE          2673          DEFCHR 0F8H,080H,080H,0E0H,080H,080H,080H ;  F
09EE F8       2673 +        DEFB 0F8H
09EF 80       2673 +        DEFB 080H
09F0 80       2673 +        DEFB 080H
09F1 E0       2673 +        DEFB 0E0H
09F2 80       2673 +        DEFB 080H
09F3 80       2673 +        DEFB 080H
09F4 80       2673 +        DEFB 080H
09F5          2674          DEFCHR 070H,088H,080H,080H,098H,088H,078H ;  G
09F5 70       2674 +        DEFB 070H
```

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ADDR OBJECT   STMT  LABEL    OPCD OPERAND       COMMENT

09F6 88       2674 +         DEFB 088H
09F7 80       2674 +         DEFB 080H
09F8 80       2674 +         DEFB 080H
09F9 98       2674 +         DEFB 098H
09FA 88       2674 +         DEFB 088H
09FB 78       2674 +         DEFB 078H
09FC          2675           DEFCHR 088H,088H,088H,0F8H,088H,088H,088H ; H
09FC 88       2675 +         DEFB 088H
09FD 88       2675 +         DEFB 088H
09FE 88       2675 +         DEFB 088H
09FF F8       2675 +         DEFB 0F8H
0A00 88       2675 +         DEFB 088H
0A01 88       2675 +         DEFB 088H
0A02 88       2675 +         DEFB 088H
0A03          2676           DEFCHR 070H,020H,020H,020H,020H,020H,070H ; I
0A03 70       2676 +         DEFB 070H
0A04 20       2676 +         DEFB 020H
0A05 20       2676 +         DEFB 020H
0A06 20       2676 +         DEFB 020H
0A07 20       2676 +         DEFB 020H
0A08 20       2676 +         DEFB 020H
0A09 70       2676 +         DEFB 070H
0A0A          2677           DEFCHR 008H,008H,008H,008H,008H,088H,070H ; J
0A0A 08       2677 +         DEFB 008H
0A0B 08       2677 +         DEFB 008H
0A0C 08       2677 +         DEFB 008H
0A0D 08       2677 +         DEFB 008H
0A0E 08       2677 +         DEFB 008H
0A0F 88       2677 +         DEFB 088H
0A10 70       2677 +         DEFB 070H
0A11          2678           DEFCHR 088H,090H,0A0H,0C0H,0A0H,090H,088H ; K
0A11 88       2678 +         DEFB 088H
0A12 90       2678 +         DEFB 090H
0A13 A0       2678 +         DEFB 0A0H
0A14 C0       2678 +         DEFB 0C0H
0A15 A0       2678 +         DEFB 0A0H
0A16 90       2678 +         DEFB 090H
0A17 88       2678 +         DEFB 088H
0A18          2679           DEFCHR 080H,080H,080H,080H,080H,080H,0F8H ; L
0A18 80       2679 +         DEFB 080H
0A19 80       2679 +         DEFB 080H
0A1A 80       2679 +         DEFB 080H
0A1B 80       2679 +         DEFB 080H
0A1C 80       2679 +         DEFB 080H
0A1D 80       2679 +         DEFB 080H
0A1E F8       2679 +         DEFB 0F8H
0A1F          2680           DEFCHR 088H,0D8H,0A8H,0A8H,088H,088H,088H ; M
0A1F 88       2680 +         DEFB 088H
0A20 D8       2680 +         DEFB 0D8H
0A21 A8       2680 +         DEFB 0A8H
0A22 A8       2680 +         DEFB 0A8H
0A23 88       2680 +         DEFB 088H
0A24 88       2680 +         DEFB 088H
0A25 88       2680 +         DEFB 088H
0A26          2681           DEFCHR 088H,0C8H,0A8H,098H,088H,088H,088H ; N
0A26 88       2681 +         DEFB 088H
0A27 C8       2681 +         DEFB 0C8H
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

0A28 A8        2681 +         DEFB 0A8H
0A29 98        2681 +         DEFB 098H
0A2A 88        2681 +         DEFB 088H
0A2B 88        2681 +         DEFB 088H
0A2C 88        2681 +         DEFB 088H
0A2D           2682           DEFCHR 0F8H,088H,088H,088H,088H,088H,0F8H ;  O
0A2D F8        2682 +         DEFB 0F8H
0A2E 88        2682 +         DEFB 088H
0A2F 88        2682 +         DEFB 088H
0A30 88        2682 +         DEFB 088H
0A31 88        2682 +         DEFB 088H
0A32 88        2682 +         DEFB 088H
0A33 F8        2682 +         DEFB 0F8H
0A34           2683           DEFCHR 0F0H,088H,088H,0F0H,080H,080H,080H ;  P
0A34 F0        2683 +         DEFB 0F0H
0A35 88        2683 +         DEFB 088H
0A36 88        2683 +         DEFB 088H
0A37 F0        2683 +         DEFB 0F0H
0A38 80        2683 +         DEFB 080H
0A39 80        2683 +         DEFB 080H
0A3A 80        2683 +         DEFB 080H
0A3B           2684           DEFCHR 070H,088H,088H,088H,0A8H,090H,068H ;  Q
0A3B 70        2684 +         DEFB 070H
0A3C 88        2684 +         DEFB 088H
0A3D 88        2684 +         DEFB 088H
0A3E 88        2684 +         DEFB 088H
0A3F A8        2684 +         DEFB 0A8H
0A40 90        2684 +         DEFB 090H
0A41 68        2684 +         DEFB 068H
0A42           2685           DEFCHR 0F0H,088H,088H,0F0H,0A0H,090H,088H ;  R
0A42 F0        2685 +         DEFB 0F0H
0A43 88        2685 +         DEFB 088H
0A44 88        2685 +         DEFB 088H
0A45 F0        2685 +         DEFB 0F0H
0A46 A0        2685 +         DEFB 0A0H
0A47 90        2685 +         DEFB 090H
0A48 88        2685 +         DEFB 088H
0A49           2686           DEFCHR 070H,088H,080H,070H,008H,088H,070H ;  S
0A49 70        2686 +         DEFB 070H
0A4A 88        2686 +         DEFB 088H
0A4B 80        2686 +         DEFB 080H
0A4C 70        2686 +         DEFB 070H
0A4D 08        2686 +         DEFB 008H
0A4E 88        2686 +         DEFB 088H
0A4F 70        2686 +         DEFB 070H
0A50           2687           DEFCHR 0F8H,020H,020H,020H,020H,020H,020H ;  T
0A50 F8        2687 +         DEFB 0F8H
0A51 20        2687 +         DEFB 020H
0A52 20        2687 +         DEFB 020H
0A53 20        2687 +         DEFB 020H
0A54 20        2687 +         DEFB 020H
0A55 20        2687 +         DEFB 020H
0A56 20        2687 +         DEFB 020H
0A57           2688           DEFCHR 088H,088H,088H,088H,088H,088H,070H ;  U
0A57 88        2688 +         DEFB 088H
0A58 88        2688 +         DEFB 088H
0A59 88        2688 +         DEFB 088H
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

0A5A 88        2688 +         DEFB 088H
0A5B 88        2688 +         DEFB 088H
0A5C 88        2688 +         DEFB 088H
0A5D 70        2688 +         DEFB 070H
0A5E           2689           DEFCHR 088H,088H,088H,050H,050H,020H,020H ; V
0A5E 88        2689 +         DEFB 088H
0A5F 88        2689 +         DEFB 088H
0A60 88        2689 +         DEFB 088H
0A61 50        2689 +         DEFB 050H
0A62 50        2689 +         DEFB 050H
0A63 20        2689 +         DEFB 020H
0A64 20        2689 +         DEFB 020H
0A65           2690           DEFCHR 088H,088H,088H,0A8H,0A8H,0D8H,088H ; W
0A65 88        2690 +         DEFB 088H
0A66 88        2690 +         DEFB 088H
0A67 88        2690 +         DEFB 088H
0A68 A8        2690 +         DEFB 0A8H
0A69 A8        2690 +         DEFB 0A8H
0A6A D8        2690 +         DEFB 0D8H
0A6B 88        2690 +         DEFB 088H
0A6C           2691           DEFCHR 088H,088H,050H,020H,050H,088H,088H ; X
0A6C 88        2691 +         DEFB 088H
0A6D 88        2691 +         DEFB 088H
0A6E 50        2691 +         DEFB 050H
0A6F 20        2691 +         DEFB 020H
0A70 50        2691 +         DEFB 050H
0A71 88        2691 +         DEFB 088H
0A72 88        2691 +         DEFB 088H
0A73           2692           DEFCHR 088H,088H,050H,020H,020H,020H,020H ; Y
0A73 88        2692 +         DEFB 088H
0A74 88        2692 +         DEFB 088H
0A75 50        2692 +         DEFB 050H
0A76 20        2692 +         DEFB 020H
0A77 20        2692 +         DEFB 020H
0A78 20        2692 +         DEFB 020H
0A79 20        2692 +         DEFB 020H
0A7A           2693           DEFCHR 0F8H,008H,010H,020H,040H,080H,0F8H ; Z
0A7A F8        2693 +         DEFB 0F8H
0A7B 08        2693 +         DEFB 008H
0A7C 10        2693 +         DEFB 010H
0A7D 20        2693 +         DEFB 020H
0A7E 40        2693 +         DEFB 040H
0A7F 80        2693 +         DEFB 080H
0A80 F8        2693 +         DEFB 0F8H
0A81           2694           DEFCHR 070H,040H,040H,040H,040H,040H,070H ; [
0A81 70        2694 +         DEFB 070H
0A82 40        2694 +         DEFB 040H
0A83 40        2694 +         DEFB 040H
0A84 40        2694 +         DEFB 040H
0A85 40        2694 +         DEFB 040H
0A86 40        2694 +         DEFB 040H
0A87 70        2694 +         DEFB 070H
0A88           2695           DEFCHR 000H,080H,040H,020H,010H,008H,000H ; \
0A88 00        2695 +         DEFB 000H
0A89 80        2695 +         DEFB 080H
0A8A 40        2695 +         DEFB 040H
0A8B 20        2695 +         DEFB 020H
```

```
ADDR OBJECT    STMT  LABEL   OPCD OPERAND      COMMENT

0A8C 10        2695 +        DEFB 010H
0A8D 08        2695 +        DEFB 008H
0A8E 00        2695 +        DEFB 000H
0A8F           2696          DEFCHR 070H,010H,010H,010H,010H,010H,070H ;  ]
0A8F 70        2696 +        DEFB 070H
0A90 10        2696 +        DEFB 010H
0A91 10        2696 +        DEFB 010H
0A92 10        2696 +        DEFB 010H
0A93 10        2696 +        DEFB 010H
0A94 10        2696 +        DEFB 010H
0A95 70        2696 +        DEFB 070H
0A96           2697          DEFCHR 020H,070H,0A8H,020H,020H,020H,020H ;  ^
0A96 20        2697 +        DEFB 020H
0A97 70        2697 +        DEFB 070H
0A98 A8        2697 +        DEFB 0A8H
0A99 20        2697 +        DEFB 020H
0A9A 20        2697 +        DEFB 020H
0A9B 20        2697 +        DEFB 020H
0A9C 20        2697 +        DEFB 020H
0A9D           2698          DEFCHR 000H,020H,040H,0F8H,040H,020H,000H ;  ←
0A9D 00        2698 +        DEFB 000H
0A9E 20        2698 +        DEFB 020H
0A9F 40        2698 +        DEFB 040H
0AA0 F8        2698 +        DEFB 0F8H
0AA1 40        2698 +        DEFB 040H
0AA2 20        2698 +        DEFB 020H
0AA3 00        2698 +        DEFB 000H
0AA4           2699          DEFCHR 020H,020H,020H,020H,0A8H,070H,020H ;  DOWN
0AA4 20        2699 +        DEFB 020H
0AA5 20        2699 +        DEFB 020H
0AA6 20        2699 +        DEFB 020H
0AA7 20        2699 +        DEFB 020H
0AA8 A8        2699 +        DEFB 0A8H
0AA9 70        2699 +        DEFB 070H
0AAA 20        2699 +        DEFB 020H
0AAB           2700          DEFCHR 000H,020H,010H,0F8H,010H,020H,000H ;  RIGHT
0AAB 00        2700 +        DEFB 000H
0AAC 20        2700 +        DEFB 020H
0AAD 10        2700 +        DEFB 010H
0AAE F8        2700 +        DEFB 0F8H
0AAF 10        2700 +        DEFB 010H
0AB0 20        2700 +        DEFB 020H
0AB1 00        2700 +        DEFB 000H
0AB2           2701          DEFCHR 000H,088H,050H,020H,050H,088H,000H ;  MULTI
0AB2 00        2701 +        DEFB 000H
0AB3 88        2701 +        DEFB 088H
0AB4 50        2701 +        DEFB 050H
0AB5 20        2701 +        DEFB 020H
0AB6 50        2701 +        DEFB 050H
0AB7 88        2701 +        DEFB 088H
0AB8 00        2701 +        DEFB 000H
0AB9 00        2702          DEFB 0
0ABA 20        2703          DEFB 20H
0ABB 00        2704          DEFB 0
0ABC F8        2705          DEFB 0F8H
0ABD 00        2706          DEFB 0
0ABE 20        2707          DEFB 20H
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

               2708  ; ** LAST BYTE OF DIVIDE IS ZERO, WHICH HAPPENS TO BE FIR
               2709  ;      BYTE OF ...
               2710   ; SMALL CHARACTERS (4 X 6)
0ABF           2711  SMLCHR
0ABF           2712           DEF5 000H,000H,000H,000H,000H ; SPACE
0ABF 00        2712 +         DEFB 000H
0AC0 00        2712 +         DEFB 000H
0AC1 00        2712 +         DEFB 000H
0AC2 00        2712 +         DEFB 000H
0AC3 00        2712 +         DEFB 000H

0AC4 DDE1      2714  MMJUMP:  POP  IX
0AC6 E3        2715           EX   (SP),HL
0AC7 DDE9      2716           JP   (IX)

               2718  ;NAME:   CONVERT KEY CODE TO ASCII
               2719  ;PURPOSE:   SAME
               2720  ;INPUT:   A=KEY CODE
               2721  ;OUTPUT:   A=ASCII EQUIVALENT
               2722  ;HOW:   TABLE LOOKUP
0AC9           2723  MKCTAS:
0AC9 48        2724           LD   C,B
0ACA 0600      2725           LD   B,0
0ACC 21D50A    2726           LD   HL,KCTATB
0ACF 09        2727           ADD  HL,BC
0AD0 7E        2728           LD   A,(HL)
0AD1 FD7709    2729  QFROG:   LD   (IY+CBA),A
0AD4 C9        2730           RET

0AD5           2732  KCTATB:
0AD5 20        2733           DEFB ' '             ;SPACE
0AD6 43        2734           DEFB 'C'             ;BULLET
0AD7 5E        2735           DEFB 5EH             ;UP ARROW
0AD8 5C        2736           DEFB 5CH             ;DOWN ARROW
0AD9 25        2737           DEFB '%'             ;
0ADA 52        2738           DEFB 'R'             ;RECALL
0ADB 53        2739           DEFB 'S'             ;STORE
0ADC 3B        2740           DEFB ';'             ;PLUS-MINUS
0ADD 2F        2741           DEFB '/'             ; DIVIDE
0ADE 37        2742           DEFB '7'
0ADF 38        2743           DEFB '8'
0AE0 39        2744           DEFB '9'
0AE1 2A        2745           DEFB '*'             ;TIMES
0AE2 34        2746           DEFB '4'
0AE3 35        2747           DEFB '5'
0AE4 36        2748           DEFB '6'
0AE5 2D        2749           DEFB '-'             ;MINUS
0AE6 31        2750           DEFB '1'
0AE7 32        2751           DEFB '2'
0AE8 33        2752           DEFB '3'
0AE9 2B        2753           DEFB '+'             ;PLUS
0AEA 26        2754           DEFB '&'             ;CE
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

0AEB 30        2755           DEFB '0'
0AEC 2E        2756           DEFB '.'            ;POINT
0AED 3D        2757           DEFB '='            ;EQUALS

               2759   ; NAME:             FILL AREA
               2760   ; PURPOSE:          SET REGION OF SCREEN TO CONSTANT VALUE
               2761   ; INPUT:            A = DATA TO FILL WITH
               2762   ;                   BC = NUMBER OF BYTES TO FILL
               2763   ;                   DE = STARTING ADDRESS OF REGION TO FILL
0AEE EB        2764  MFILL:   EX   DE,HL
0AEF 77        2765  MFILL1:  LD   (HL),A         ; STUFF BYTE
0AF0 EDA1      2766           CPI                 ; BUMP HL, DEC BC
0AF2 EAEF0A    2767           JP   PE,MFILL1
0AF5 C9        2768           RET

               2770   ; NAME:             RELATIVE TO ABSOLUTE
               2771   ; PURPOSE:          COORDINATE CONVERSION
               2772   ; INPUT:            E = X COORDINATE
               2773   ;                   D = Y COORDINATE
               2774   ;                   A = MAGIC REGISTER VALUE TO USE
               2775   ; OUTPUT:           DE = ABSOLUTE ADDRESS
               2776   ;                   A = MAGIC REGISTER TO USE
               2777  ; MAGIC ENTRY POINT
0AF6 CD080B    2778  MRELAB:  CALL RELTA
0AF9 1805      2779           JR   MRELA2-$
               2780  ; NONMAGIC ENTRY POINT
0AFB CD4E0B    2781  MRELA1:  CALL RELTA1
0AFE CBF2      2782           SET  6,D            ; NONMAGIC THE ADDRESS
0B00 FD7304    2783  MRELA2:  LD   (IY+CBE),E     ; UPDATE CB DE
0B03 FD7205    2784           LD   (IY+CBD),D
0B06 18C9      2785  MFROG:   JR   QFROG-$
               2786  ; MAGIC ENTRY POINT
0B08 CD4E0B    2787  RELTA:   CALL RELTA1
0B0B D30C      2788           OUT  (MAGIC),A
0B0D C9        2789           RET
0B0E 00        2790  CKSUM2:  DEFB 0              ; *** CHECKSUM ***
0B0F           2791           DEFS 0E0H,0A0H,0A0H,0A0H,0E0H ;  0
0B0F E0        2791 +         DEFB 0E0H
0B10 A0        2791 +         DEFB 0A0H
0B11 A0        2791 +         DEFB 0A0H
0B12 A0        2791 +         DEFB 0A0H
0B13 E0        2791 +         DEFB 0E0H
0B14           2792           DEFS 040H,040H,040H,040H,040H ;  1
0B14 40        2792 +         DEFB 040H
0B15 40        2792 +         DEFB 040H
0B16 40        2792 +         DEFB 040H
0B17 40        2792 +         DEFB 040H
0B18 40        2792 +         DEFB 040H
0B19           2793           DEFS 0E0H,020H,0E0H,080H,0E0H ;  2
0B19 E0        2793 +         DEFB 0E0H
0B1A 20        2793 +         DEFB 020H
0B1B E0        2793 +         DEFB 0E0H
0B1C 80        2793 +         DEFB 080H
```

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ADDR OBJECT    STMT   LABEL    OPCD OPERAND       COMMENT

0B1D E0        2793 +          DEFB 0E0H
0B1E           2794            DEF5 0E0H,020H,060H,020H,0E0H ;  3
0B1E E0        2794 +          DEFB 0E0H
0B1F 20        2794 +          DEFB 020H
0B20 60        2794 +          DEFB 060H
0B21 20        2794 +          DEFB 020H
0B22 E0        2794 +          DEFB 0E0H
0B23           2795            DEF5 0A0H,0A0H,0E0H,020H,020H ;  4
0B23 A0        2795 +          DEFB 0A0H
0B24 A0        2795 +          DEFB 0A0H
0B25 E0        2795 +          DEFB 0E0H
0B26 20        2795 +          DEFB 020H
0B27 20        2795 +          DEFB 020H
0B28           2796            DEF5 0E0H,080H,0E0H,020H,0E0H ;  5
0B28 E0        2796 +          DEFB 0E0H
0B29 80        2796 +          DEFB 080H
0B2A E0        2796 +          DEFB 0E0H
0B2B 20        2796 +          DEFB 020H
0B2C E0        2796 +          DEFB 0E0H
0B2D           2797            DEF5 0E0H,080H,0E0H,0A0H,0E0H ;  6
0B2D E0        2797 +          DEFB 0E0H
0B2E 80        2797 +          DEFB 080H
0B2F E0        2797 +          DEFB 0E0H
0B30 A0        2797 +          DEFB 0A0H
0B31 E0        2797 +          DEFB 0E0H
0B32           2798            DEF5 0E0H,020H,020H,020H,020H ;  7
0B32 E0        2798 +          DEFB 0E0H
0B33 20        2798 +          DEFB 020H
0B34 20        2798 +          DEFB 020H
0B35 20        2798 +          DEFB 020H
0B36 20        2798 +          DEFB 020H
0B37           2799            DEF5 0E0H,0A0H,0E0H,0A0H,0E0H ;  8
0B37 E0        2799 +          DEFB 0E0H
0B38 A0        2799 +          DEFB 0A0H
0B39 E0        2799 +          DEFB 0E0H
0B3A A0        2799 +          DEFB 0A0H
0B3B E0        2799 +          DEFB 0E0H
0B3C           2800            DEF5 0E0H,0A0H,0E0H,020H,0E0H ;  9
0B3C E0        2800 +          DEFB 0E0H
0B3D A0        2800 +          DEFB 0A0H
0B3E E0        2800 +          DEFB 0E0H
0B3F 20        2800 +          DEFB 020H
0B40 E0        2800 +          DEFB 0E0H
0B41           2801            DEF5 000H,040H,000H,040H,000H ;  :
0B41 00        2801 +          DEFB 000H
0B42 40        2801 +          DEFB 040H
0B43 00        2801 +          DEFB 000H
0B44 40        2801 +          DEFB 040H
0B45 00        2801 +          DEFB 000H
0B46           2802            DEF5 040H,0E0H,0E0H,0E0H,0E0H ;  BULLET
0B46 40        2802 +          DEFB 040H
0B47 E0        2802 +          DEFB 0E0H
0B48 E0        2802 +          DEFB 0E0H
0B49 E0        2802 +          DEFB 0E0H
0B4A E0        2802 +          DEFB 0E0H
```

```
               2804  ; MOVE ROUTINE
0B4B EDB0      2805  MMOVE:   LDIR
0B4D C9        2806           RET

               2808   ; SYSTEM ENTRY POINT FOR NONMAGIC ADDRESSES
0B4E E5        2809  RELTA1:  PUSH HL
0B4F E6FC      2810           AND  0FCH           ; TOSS OUT SHIFT AMOUNT
0B51 6F        2811           LD   L,A            ; SAVE
0B52 7B        2812           LD   A,E            ; GET X
0B53 E603      2813           AND  03H            ; ISOLATE SHIFT AMOUNT
0B55 B5        2814           OR   L              ; COMBINE WITH MR
0B56 F5        2815  RELTA2:  PUSH AF
0B57 E640      2816           AND  040H           ; IS FLOPPED BIT SET?
0B59 7B        2817           LD   A,E
0B5A 2803      2818           JR   Z,RELTA3-$     ; JUMP IF NOT
0B5C 2F        2819           CPL                 ; YEP - UNFLOP THE COORDINATE
0B5D C6A0      2820           ADD  A,160
0B5F 6A        2821  RELTA3:  LD   L,D            ; HL = Y
0B60 2600      2822           LD   H,0
0B62 29        2823           ADD  HL,HL          ; SET HL = Y * 8
0B63 29        2824           ADD  HL,HL
0B64 29        2825           ADD  HL,HL
0B65 54        2826           LD   D,H
0B66 5D        2827           LD   E,L
0B67 29        2828           ADD  HL,HL          ; SET HL = Y * 32
0B68 29        2829           ADD  HL,HL
0B69 19        2830           ADD  HL,DE          ; SET HL = Y * 40
0B6A CB3F      2831           SRL  A              ; A = X 4
0B6C CB3F      2832           SRL  A
0B6E 5F        2833           LD   E,A
0B6F 1600      2834           LD   D,0
0B71 19        2835           ADD  HL,DE          ; HL = Y * 40 + X        4
               2836           IF   NWHDWR-1
               2837           ENDIF
0B72 EB        2838           EX   DE,HL

               2840  ; NAME:           RETURN FROM MACRO SUBROUTINE
               2841  ; PURPOSE:        RETURN CONTROL TO CALLER
               2842  ; THIS CODE WAS 'STOLEN' FROM RELABS SINCE
               2843  ; IT DOES THE STACK CLEANUP THAT MRET DOES
0B73 F1        2844  MMRET:   POP  AF
0B74 E1        2845           POP  HL
0B75 C9        2846           RET

               2848  ; ENTRY FOR USER
0B76 CD7B0B    2849  INXNIB:  CALL XNIB
0B79 188B      2850           JR   MFROG-$
```

```
ADDR OBJECT    STMT   LABEL    OPCD OPERAND        COMMENT


               2852   ; NAME:            INDEX NIBBLE
               2853   ; PURPOSE:         LOAD OF SPECIFIED NIBBLE RELATIVE TO BASE
               2854   ; INPUT:           C = NIBBLE NUMBER
               2855   ;                  HL = BASE ADDRESS
               2856   ; OUTPUT:          NIBBLE RETURNED RIGHT JUSTIFIED IN A.
               2857   ; DESCRIPTION:   BYTE = NIBBLE#          2+BASE
               2858   ;  THE LOW ORDER NIBBLE OF A GIVEN BYTE IS ADDRESSED
               2859   ; BY AN EVEN NIBBLE NUMBER.
0B7B E5        2860   XNIB:    PUSH HL
0B7C C5        2861            PUSH BC
0B7D 0600      2862            LD   B,0
0B7F CB39      2863            SRL  C
0B81 09        2864            ADD  HL,BC
0B82 7E        2865            LD   A,(HL)
0B83 C1        2866            POP  BC
0B84 CB41      2867            BIT  0,C
0B86 2804      2868            JR   Z,XNIB1-$
0B88 0F        2869            RRCA
0B89 0F        2870            RRCA
0B8A 0F        2871            RRCA
0B8B 0F        2872            RRCA
0B8C E60F      2873   XNIB1:   AND  0FH
0B8E E1        2874            POP  HL
0B8F C9        2875            RET


               2877   ; NAME:            STORE NIBBLE
               2878   ; PURPOSE:         NIBBLE STORING (!)
               2879   ; INPUT:           A = NIBBLE TO STORE
               2880   ;                  C = NIBBLE NUMBER (AS IN XNIB)
               2881   ;        HL = BASE ADDRESS
0B90 E5        2882   PUTNIB:  PUSH HL
0B91 C5        2883            PUSH BC
0B92 0600      2884            LD   B,0
0B94 CB39      2885            SRL  C
0B96 09        2886            ADD  HL,BC
0B97 C1        2887            POP  BC
0B98 CB41      2888            BIT  0,C
0B9A 2809      2889            JR   Z,PUTNB1-$
               2890   ; H.O.  CASE - SHIFT IT
0B9C 07        2891            RLCA
0B9D 07        2892            RLCA
0B9E 07        2893            RLCA
0B9F 07        2894            RLCA
0BA0 AE        2895            XOR  (HL)
0BA1 E6F0      2896            AND  0F0H
0BA3 1803      2897            JR   PUTNB2-$
0BA5 AE        2898   PUTNB1:  XOR  (HL)          ; L.O.  CASE
0BA6 E60F      2899            AND  0FH
0BA8 AE        2900   PUTNB2:  XOR  (HL)
0BA9 77        2901            LD   (HL),A
0BAA E1        2902            POP  HL
0BAB C9        2903            RET
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND       COMMENT

                2905  ; NAME :  INDEX WORD TABLE (WORD INDEX)
                2906  ; PURPOSE: TO INDEX AN ARRAY OF DEFW'S
                2907  ; INPUTS: A=INDEX NUMBER (0-255)
                2908  ; HL -> TABLE ENTRY 0
                2909  ; OUTPUTS:        DE = ENTRY LOOKED UP
                2910  ;                 HL = POINTER TO ENTRY IN TABLE
0BAC 5F         2911  MINDW:  LD   E,A
0BAD 1600       2912          LD   D,0
0BAF CB23       2913          SLA  E
0BB1 CB12       2914          RL   D             ; DE*2
0BB3 19         2915          ADD  HL,DE
0BB4 5E         2916          LD   E,(HL)
0BB5 23         2917          INC  HL
0BB6 56         2918          LD   D,(HL)
0BB7 2B         2919          DEC  HL
0BB8 CDF40C     2920  STHLDE: CALL FINDL3
0BBB 1808       2921          JR   MINDB1-$      ; JOIN STORE IN INDEX BYTE

                2923  ; NAME:           INDEX BYTE TABLE
                2924  ; PURPOSE:        TABLE LOOKUP
                2925  ; INPUTS:         A = INDEX NUMBER
                2926  ; OUTPUT:         A = VALUE OF BYTE
                2927  ;                 HL = POINTER TO TABLE ENTRY
0BBD 5F         2928  MINDB:  LD   E,A
0BBE 1600       2929          LD   D,0
0BC0 19         2930          ADD  HL,DE
0BC1 7E         2931          LD   A,(HL)
0BC2 FD7709     2932          LD   (IY+CBA),A
0BC5 FD740B     2933  MINDB1: LD   (IY+CBH),H
0BC8 FD750A     2934          LD   (IY+CBL),L
0BCB C9         2935          RET

                2937  ; NAME:     DISPLAY TIME
                2938  ; PURPOSE: DISPLAY TIME ON SCREEN
                2939  ; INPUTS:  E = X COORD
                2940  ;          D = Y COORD
                2941  ;          C = SAME AS DISCHR OPTIONS EXCEPT BIT 7 = 1
                2942  ;              TO DISPLAY COLON AND SECONDS
                2943  ; OUTPUTS: NONE
0BCC            2944  MDISTI:
0BCC DD210D02   2945          LD   IX,SMLFNT
0BD0 0642       2946          LD   B,42H
0BD2 21EE4F     2947          LD   HL,GTMINS
0BD5 C5         2948          PUSH BC
0BD6 FDCB06BE   2949          RES  7,(IY+CBC)
0BDA CDEB0B     2950          CALL BCDISP
0BDD C1         2951          POP  BC
0BDE CB79       2952          BIT  7,C
0BE0 C8         2953          RET  Z
0BE1 3EBA       2954          LD   A,80H+3AH
```

```
ADDR OBJECT   STMT  LABEL    OPCD OPERAND      COMMENT

0BE3 CDE107   2955           CALL DISPCH
0BE6 0642     2956           LD   B,42H
0BE8 21ED4F   2957           LD   HL,GTSECS
              2958  ; AND FALL INTO ...


              2960  ; NAME:           DISPLAY BCD NUMBER
              2961  ; INPUT:          B = NUMBER DISPLAY OPTIONS
              2962  ;                 C = CHARACTER DISPLAY OPTIONS
              2963  ;                 DE = Y,X COORDINATES
              2964  ;                 HL = NUMBER ADDRESS (POINTS AT LO BYTE)
              2965  ;                 IX = ALTERNATE FONT (IF USED)
              2966  ; OUTPUT:         DE UPDATED
              2967  ; DESCRIPTION:  THIS ROUTINE CONVERTS EACH NIBBLE INTO
              2968  ; ASCII AND DISPLAYS IT.  THE NORMALLY ILLEGAL BCD
              2969  ; VALUES ARE DISPLAYED AS CODES 2A THRU 2F RESPECTIVELY.
              2970  ; THE NUMBER DISPLAY OPTIONS BYTE IS FORMATED AS FOLLOWS:
              2971  ; BIT 7           SET IF LEADING ZERO SURPRESSION WANTED
              2972  ; BIT 6           SET IF USE OF ALTERNATE FONT WANTED
              2973  ; BITS 5-0        NUMBER OF DIGITS TO DISPLAY (NOT NUMBER O
0BEB 78       2974  BCDISP: LD   A,B           ; GET OPTIONS
0BEC E63F     2975           AND  3FH           ; ISOLATE NUMBER OF DIGITS
0BEE 3D       2976  BCDD0:   DEC  A
0BEF F8       2977           RET  M             ; QUIT IF NULL OR NO MORE
0BF0 4F       2978           LD   C,A           ; SAVE
0BF1 CD7B0B   2979           CALL XNIB          ; GET NEXT DIGIT
0BF4 2007     2980           JR   NZ,BCDD1-$    ; JUMP IF NONZERO
0BF6 CB78     2981           BIT  7,B           ; IS ZERO SURPRESS ON?
0BF8 2803     2982           JR   Z,BCDD1-$     ; JUMP IF NOT
0BFA B1       2983           OR   C             ; LAST DIGIT?
0BFB 2014     2984           JR   NZ,BCDD4-$    ; JUMP IF NOT
0BFD CBB8     2985  BCDD1:   RES  7,B           ; CLEAR LEADING ZERO FLAG
0BFF C606     2986           ADD  A,6
0C01 E60F     2987           AND  0FH
0C03 C62A     2988           ADD  A,2AH
0C05 CB70     2989  BCDD2:   BIT  6,B           ; ALTERNATE FONT?
0C07 2802     2990           JR   Z,BCDD3-$     ; JUMP IF NO
0C09 F680     2991           OR   80H           ; YEA - SET THE BIT
0C0B CDE107   2992  BCDD3:   CALL DISPCH        ; DISPLAY THE CHAR
0C0E 79       2993           LD   A,C           ; GET LOOP COUNTER IN A
0C0F 18DD     2994           JR   BCDD0-$       ; AND GO FOR NEXT
0C11 3E20     2995  BCDD4:   LD   A,' '         ; LEADING ZERO - WRITE A SPACE
0C13 18F0     2996           JR   BCDD2-$


              2998  ; NAME:     INCREMENT SCORE
              2999  ; PURPOSE:  INCREMENT SCORE AND COMPARE TO END SCORE
              3000  ; INPUTS:   HL -> PLAYER SCORE LOW ADDR OF 3 BYTES
              3001  ; OUTPUTS:  GSBEND OF GAMSTB SET IF MAX SCORE REACHED
0C15 0603     3002  MINCSC:  LD   B,3
0C17 E5       3003           PUSH HL
0C18 7E       3004  INCLOP:  LD   A,(HL)
0C19 C601     3005           ADD  A,1
0C1B 27       3006           DAA
0C1C 77       3007           LD   (HL),A
```

```
ADDR OBJECT   STMT  LABEL    OPCD OPERAND       COMMENT

0C1D 2003     3008           JR   NZ,CMPIT-$
0C1F 23       3009           INC  HL
0C20 10F6     3010           DJNZ INCLOP-$
0C22 E1       3011  CMPIT:   POP  HL
0C23 23       3012           INC  HL
0C24 23       3013           INC  HL
0C25 3AF84F   3014           LD   A,(GAMSTB)
0C28 CB4F     3015           BIT  GSBSCR,A
0C2A C8       3016           RET  Z
0C2B 11F64F   3017           LD   DE,ENDSCR+2
0C2E 0603     3018           LD   B,3
0C30 1A       3019  CMPLOP:  LD   A,(DE)
0C31 BE       3020           CP   (HL)
0C32 2807     3021           JR   Z,REPEAT-$    ;ENDSCR = SCORE
0C34 D0       3022           RET  NC            ;ENDSCR > SCORE
0C35 21F84F   3023  SETEND:  LD   HL,GAMSTB     ;ENDSCR < SCORE
0C38 CBFE     3024           SET  GSBEND,(HL)
0C3A C9       3025           RET
0C3B 1B       3026  REPEAT:  DEC  DE
0C3C 2B       3027           DEC  HL
0C3D 10F1     3028           DJNZ CMPLOP-$
0C3F 18F4     3029           JR   SETEND-$


              3031  ; NAME:           QUIT
              3032  ; PURPOSE:        HOLD PRESENT GAME SCORE UNTIL KEY HIT OR
              3033  ; SAY GAME OVER
0C41          3034  MQUIT:   SYSSUK STRDIS
0C41 FF       3034 +         RST  56
0C42 35       3034 +         DEFB STRDIS+1
              3034 +         IF   STRDIS.EQ.INTPC
              3034 +         ENDIF
0C43 30       3035           DEFB 48
0C44 18       3036           DEFB 24
0C45 4C       3037           DEFB 01001100B
0C46 570C     3038           DEFW GMOVR
0C48          3039           SYSTEM ACTINT      ; ACTIVATE INTERRUPTS
0C48 FF       3039 +         RST  56
0C49 0E       3039 +         DEFB ACTINT
              3039 +         IF   ACTINT.EQ.INTPC
              3039 +         ENDIF
0C4A          3040  MQUIT1:  SYSSUK SENTRY      ; WAIT FOR SOMETHING TO HAPPEN
0C4A FF       3040 +         RST  56
0C4B 43       3040 +         DEFB SENTRY+1
              3040 +         IF   SENTRY.EQ.INTPC
              3040 +         ENDIF
0C4C 1402     3041           DEFW AKEYS
0C4E FE14     3042           CP   STO
0C50 2804     3043           JR   Z,MQUIT2-$    ; TRIGGER CHANGE?
0C52 FE13     3044           CP   SKYD          ; KEY HIT?
0C54 20F4     3045           JR   NZ,MQUIT1-$   ; NO - KEEP GOING
0C56 C7       3046  MQUIT2:  RST  0             ; YES - RESET
0C57 47414D45 3047  GMOVR:   DEFM 'GAME'
0C5B 06       3048           DEFB 6
0C5C 4F564552 3049           DEFM 'OVER'
0C60 00       3050           DEFB 0
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

               3052  ; *****************
               3053  ; * MENU ROUTINES *
               3054  ; *****************
>0060          3055  NOLINE   EQU  96            ; NUMBER OF DISPLAYED LINES
>0000          3056  MNNL     EQU  0             ; NEXT FIELD
>0001          3057  MNNH     EQU  1
>0002          3058  MNSAL    EQU  2             ; STRING ADDRESS
>0003          3059  MNSAH    EQU  3
>0004          3060  MNGL     EQU  4             ; GO TO ADDRESS
>0005          3061  MNGH     EQU  5

               3063  ; SYSTEM POWER UP ROUTINE
 0C61 3A0020   3064  PWRUP:   LD   A,(FIRSTC)    ; GET FIRST CASSETTE LOCATION
 0C64 FEC3     3065           CP   0C3H          ; IS IT A JUMP??
 0C66 CA0020   3066           JP   Z,FIRSTC      ; JUMP TO IT IF SO
 0C69 31CE4F   3067           LD   SP,BEGRAM
 0C6C          3068           SYSSUK FILL        ; CLEAR SYSTEM RAM
 0C6C FF       3068 +         RST  56
 0C6D 1B       3068 +         DEFB FILL+1
               3068 +         IF   FILL.EQ.INTPC
               3068 +         ENDIF
 0C6E CE4F     3069           DEFW BEGRAM
 0C70 3200     3070           DEFW 50
 0C72 00       3071           DEFB 0
 0C73 32FF0F   3072           LD   (WASTE),A     ; CLEAR SHIFTER
 0C76 3D       3073           DEC  A
 0C77 32EC4F   3074           LD   (TIMOUT),A    ; CLEAR TIMEOUT WATCHDOG
 0C7A          3075           SYSTEM INTPC
 0C7A FF       3075 +         RST  56
 0C7B 00       3075 +         DEFB INTPC
               3075 +         IF   INTPC.EQ.INTPC
>0001          3075 +INTP@    DEFL 1
               3075 +         ENDIF
 0C7C          3076           DO   EMUSIC
 0C7C 15       3076 +         DEFB EMUSIC+1
 0C7D          3077           DO   SETOUT
 0C7D 17       3077 +         DEFB SETOUT+1
 0C7E BF       3078           DEFB (NOLINE*2)-1
 0C7F 29       3079           DEFB 41
 0C80 08       3080           DEFB 8
 0C81          3081           DO   COLSET
 0C81 19       3081 +         DEFB COLSET+1
 0C82 1300     3082           DEFW MENUCL
 0C84          3083           DO   ACTINT
 0C84 0F       3083 +         DEFB ACTINT+1
 0C85          3084           EXIT
 0C85 02       3084 +         DEFB XINTC
>0000          3084 +INTP@    DEFL 0
 0C86 11F30D   3085           LD   DE,GAMSTR     ; 'SELECT GAME' AS TITLE
 0C89 210020   3086           LD   HL,FIRSTC     ; ASSUME MENU STARTS IN CASSETT
```

```
ADDR OBJECT    STMT  LABEL   OPCD OPERAND        COMMENT

0C8C 7E        3087          LD   A,(HL)       ; GET FIRST CASSETTE BYTE
0C8D 23        3088          INC  HL
0C8E FE55      3089          CP   55H          ; IS SENTINEL THERE?
0C90 2803      3090          JR   Z,PWRUP1-$   ; YEP - JUMP
0C92 211802    3091          LD   HL,GUNLNK    ; WRONG - USE ONBOARD ONLY
0C95           3092  PWRUP1: SYSTEM MENU       ; DISPLAY THE MENU
0C95 FF        3092 +        RST  56
0C96 4A        3092 +        DEFB MENU
               3092 +        IF   MENU.EQ.INTPC
               3092 +        ENDIF


               3094  ; NAME:            DISPLAY MENU AND BRANCH ON CHOICE
               3095  ; INPUT:           HL = MENU LIST
               3096  ;                  DE = MENU TITLE
               3097  ; OUTPUT:          DE = TITLE OF SELECTION MADE
               3098  ; DESCRIPTION:
               3099  ;       THE MENU LIST IS A LINKED LIST OF THE FOLLOWING F
               3100  ; ************************
               3101  ; * 0 * NEXT ENTRY       *
               3102  ; * 1 *                  *
               3103  ; ************************
               3104  ; * 2 * STRING ADDRESS   *
               3105  ; * 3 *                  *
               3106  ; ************************
               3107  ; * 4 * BRANCH TO ADDRESS *
               3108  ; * 5 *                  *
               3109  ; ************************
               3110  ; THIS LIST IS TERMINATED BY A NEXT ENTRY FIELD OF ZEROS
               3111  ; A MAXIMUM OF EIGHT ENTRYS MAY BE DISPLAYED.
0C97 E5        3112  MMENU:  PUSH HL
0C98 E5        3113          PUSH HL
0C99 CD190D    3114          CALL MNCLR        ; CLEAR SCREEN AND THROWUP TITL
0C9C           3115          XYRELL DE,16,12
0C9C 11100C    3115 +        LD   DE,.RES.(12).SHL.8+(16)
0C9F 010901    3116          LD   BC,109H      ; INITIALIZE ENTRY # AND COLOR
0CA2 DDE1      3117  MMENU1: POP  IX           ; FIRST ENTRY TO IX
0CA4 78        3118          LD   A,B          ; SELECTION NUMBER TO A
0CA5 C630      3119          ADD  A,'0'        ; MAKE IT ASCII
0CA7           3120          SYSTEM CHRDIS     ; AND SHOW IT
0CA7 FF        3120 +        RST  56
0CA8 32        3120 +        DEFB CHRDIS
               3120 +        IF   CHRDIS.EQ.INTPC
               3120 +        ENDIF
0CA9 3E2D      3121          LD   A,'-'        ; DISPLAY DASH
0CAB           3122          SYSTEM CHRDIS
0CAB FF        3122 +        RST  56
0CAC 32        3122 +        DEFB CHRDIS
               3122 +        IF   CHRDIS.EQ.INTPC
               3122 +        ENDIF
0CAD DD6603    3123          LD   H,(IX+MNSAH) ; HL = STRING ADDRESS
0CB0 DD6E02    3124          LD   L,(IX+MNSAL)
0CB3           3125          SYSTEM STRDIS     ; DISPLAY SELECTION
0CB3 FF        3125 +        RST  56
0CB4 34        3125 +        DEFB STRDIS
               3125 +        IF   STRDIS.EQ.INTPC
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

               3125 +         ENDIF
0CB5 3E08      3126           LD   A,8
0CB7 82        3127           ADD  A,D            ; TO NEXT LINE
0CB8 57        3128           LD   D,A
0CB9 1E10      3129           LD   E,16
0CBB 04        3130           INC  B              ; BUMP ENTRY #
0CBC DD6601    3131           LD   H,(IX+MNNH)    ; HL = NEXT ENTRY ADDR
0CBF DD6E00    3132           LD   L,(IX+MNNL)
0CC2 E5        3133           PUSH HL
0CC3 7C        3134           LD   A,H
0CC4 B5        3135           OR   L
0CC5 20DB      3136           JR   NZ,MMENU1-$    ; NO - JUMP BACK
               3137  ; AT THIS POINT HL = 0, (SP) = 0
0CC7 39        3138           ADD  HL,SP          ; HL = STACK POINTER
0CC8 C5        3139  MMENU3:  PUSH BC
0CC9 010101    3140           LD   BC,0101H
0CCC           3141           XYRELL DE,16,77     ; FEEDBACK ADDRESS
0CCC 11104D    3141 +         LD   DE,.RES.(77).SHL.8+(16)
0CCF           3142           SYSTEM GETNUM       ; GET NUMBA
0CCF FF        3142 +         RST  56
0CD0 4E        3142 +         DEFB GETNUM
               3142 +         IF   GETNUM.EQ.INTPC
               3142 +         ENDIF
0CD1 C1        3143           POP  BC
0CD2 7E        3144           LD   A,(HL)         ; HOW DOES SHE LOOK?
0CD3 A7        3145           AND  A              ; ZERO ENTERED?
0CD4 2803      3146           JR   Z,MMENU5-$     ; JUMP IF SO
0CD6 B8        3147           CP   B              ; IN RANGE?
0CD7 3806      3148           JR   C,MMENU6-$     ; JUMP IF SO
0CD9 3E3F      3149  MMENU5:  LD   A,'?'          ; DUD ENTRY - SHOW ?
0CDB           3150           SYSTEM CHRDIS
0CDB FF        3150 +         RST  56
0CDC 32        3150 +         DEFB CHRDIS
               3150 +         IF   CHRDIS.EQ.INTPC
               3150 +         ENDIF
0CDD 18E9      3151           JR   MMENU3-$       ; GO BACK FOR NEXT TRY
0CDF E1        3152  MMENU6:  POP  HL             ; THROW OUT ENTRY AREA
0CE0 D1        3153           POP  DE             ; RESTORE HEAD OF MENU LIST
0CE1 47        3154           LD   B,A            ; NUMBER ENTERED TO B
0CE2 EB        3155  MMENU7:  EX   DE,HL          ; HL = ENTRY PTR
0CE3 5E        3156           LD   E,(HL)         ; DE = NEXT
0CE4 23        3157           INC  HL
0CE5 56        3158           LD   D,(HL)
0CE6 10FA      3159           DJNZ MMENU7-$       ; COUNT DOWN TO ENTRY
0CE8 23        3160           INC  HL
0CE9 5E        3161           LD   E,(HL)         ; STRING TO DE
0CEA 23        3162           INC  HL
0CEB 56        3163           LD   D,(HL)
0CEC 23        3164           INC  HL
0CED 4E        3165           LD   C,(HL)         ; GO TO ADDRESS TO BC
0CEE 23        3166           INC  HL
0CEF 46        3167           LD   B,(HL)
0CF0 E1        3168           POP  HL             ; HL = RETURN TO PLACE
0CF1 F1        3169           POP  AF             ; THROW OUT OLD PC
0CF2 C5        3170           PUSH BC             ; PUT NEW PC ON STACK
0CF3 E5        3171           PUSH HL             ; AND PUT BACK DUMMY RETURN
0CF4 FD7304    3172  FINDL3:  LD   (IY+CBE),E     ; PASS BACK TITLE ADDRESS
```

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ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

0CF7 FD7205   3173          LD   (IY+CBD),D
0CFA C9       3174          RET                 ; AND GO BACK


              3176  ; NAME:           GET PARAMETER
              3177  ; PURPOSE:        INPUT OF PROGRAM OPTIONS
              3178  ; INPUT:          A = NUMBER OF DIGITS
              3179  ;                 BC = PROMPT STRING ADDRESS
              3180  ;                 DE = FRAME TITLE ADDRESS
              3181  ;                 HL = PARAMETER ADDRESS
              3182  ; DESCRIPTION:
              3183  ;       THIS ROUTINE ASKS THE USER TO ENTER A NUMBER
              3184  ; FIRST A MENU FRAME IS CREATED, USING THE STRING
              3185  ; POINTED AT BY DE AS A TITLE.  THE STRING 'ENTER'
              3186  ; IS DISPLAYED, FOLLOWED BY THE PROMPT STRING.
              3187  ; GETNUM IS THEN CALLED TO INPUT THE NUMBER.  FEEDBACK
              3188  ; IS PROVIDED IN DOUBLE SIZED CHARACTERS.
              3189  ; NOTE: ** THIS ROUTINE USES TWO SYSTEM LEVELS AND THE AL
0CFB F5       3190  MGETP:  PUSH AF             ; SAVE NUMBER OF DIGITS
0CFC E5       3191          PUSH HL
0CFD C5       3192          PUSH BC
0CFE CD190D   3193          CALL MNCLR
0D01          3194          SYSSUK STRDIS       ; DISPLAY 'ENTER'
0D01 FF       3194 +        RST  56
0D02 35       3194 +        DEFB STRDIS+1
              3194 +        IF   STRDIS.EQ.INTPC
              3194 +        ENDIF
0D03 08       3195          DEFB 8
0D04 20       3196          DEFB 32
0D05 09       3197          DEFB 1001B
0D06 B70D     3198          DEFW ENTSTG
0D08 E1       3199          POP  HL
0D09          3200          SYSTEM STRDIS       ; DISPLAY WHAT TO ENTER
0D09 FF       3200 +        RST  56
0D0A 34       3200 +        DEFB STRDIS
              3200 +        IF   STRDIS.EQ.INTPC
              3200 +        ENDIF
0D0B E1       3201          POP  HL
0D0C F1       3202          POP  AF
0D0D 47       3203          LD   B,A
0D0E CBF1     3204          SET  6,C            ; SET LARGE CHARS
0D10          3205          XYRELL DE,48,48     ; LOAD FEEDBACK ADDRESS
0D10 113030   3205 +        LD   DE,.RES.(48).SHL.8+(48)
0D13          3206          SYSTEM GETNUM       ; GET NUMBER
0D13 FF       3206 +        RST  56
0D14 4E       3206 +        DEFB GETNUM
              3206 +        IF   GETNUM.EQ.INTPC
              3206 +        ENDIF
0D15          3207          SYSSUK PAWS         ; LET USER READ IT
0D15 FF       3207 +        RST  56
0D16 51       3207 +        DEFB PAWS+1
              3207 +        IF   PAWS.EQ.INTPC
              3207 +        ENDIF
0D17 0F       3208          DEFB 15
0D18 C9       3209          RET
              3210  ; SUBROUTINE TO CLEAR SCREEN FOR MENU AND THROWUP TITLE
```

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ADDR OBJECT    STMT   LABEL    OPCD OPERAND       COMMENT

0D19 D5        3211   MNCLR:   PUSH DE
0D1A           3212            SYSSUK FILL
0D1A FF        3212 +          RST  56
0D1B 1B        3212 +          DEFB FILL+1
               3212 +          IF   FILL.EQ.INTPC
               3212 +          ENDIF
0D1C 0040      3213            DEFW NORMEM
0D1E B801      3214            DEFW 11*BYTEPL
0D20 00        3215            DEFB 0
0D21           3216            SYSSUK FILL
0D21 FF        3216 +          RST  56
0D22 1B        3216 +          DEFB FILL+1
               3216 +          IF   FILL.EQ.INTPC
               3216 +          ENDIF
0D23 B841      3217            DEFW NORMEM+(11*BYTEPL)
0D25 480D      3218            DEFW (NOLINE-11)*BYTEPL
0D27 55        3219            DEFB 55H
0D28 E1        3220            POP  HL
0D29           3221            XYRELL DE,24,0     ; TITLE
0D29 111800    3221 +          LD   DE,.RES.(0).SHL.8+(24)
0D2C 0E04      3222            LD   C,0100B
0D2E           3223            SYSTEM STRDIS
0D2E FF        3223 +          RST  56
0D2F 34        3223 +          DEFB STRDIS
               3223 +          IF   STRDIS.EQ.INTPC
               3223 +          ENDIF
0D30 C9        3224            RET


               3226   ; NAME:           GET NUMBER
               3227   ; INPUT:          B = DISNUM OPTIONS
               3228   ;                 C = CHRDIS OPTIONS FOR FEEDBACK
               3229   ;                 DE = COORDINATES OF FEEDBACK AREA
               3230   ;                 HL = ADDRESS OF WHERE TO STASH NUMBER
               3231   ; DESCRIPTION:    THIS ROUTINE CAN INPUT A NUMBER FROM
               3232   ;        EITHER THE KEYBOARD OR THE HAND CONTROL.  KEYBOAR
               3233   ;        ENTRY PROCEEDS CONVENTIONALY.  GETNUM EXITS
               3234   ;        WHEN THE EQUALS KEY IS PRESSED OR THE REQUIRED NU
               3235   ;        OF DIGITS IS ENTERED
               3236   ;                 PLAYER ONE HAND CONTROL MAY ALSO BE USED
               3237   ;        ENTER A NUMBER.  TO USE THIS OPTION, PULL THE TRI
               3238   ;        THEN ROTATE THE POT UNTIL THE NUMBER YOU WISH TO
               3239   ;        ENTER IS SHOWN IN THE FEEDBACK AREA.  PULL THE TR
               3240   ;        AGAIN TO REGISTER THE ENTRY.  IF DURING THIS PROC
               3241   ;        THE KEYBOARD IS USED - KEYBOARD INPUT WILL OVERRI
0D31 D9        3242   MGETN:   EXX
0D32 CD990D    3243            CALL CLRNUM        ; CLEAR THE NUMBER
0D35 4F        3244            LD   C,A           ; SET ZERO DIGITS IN - POT ENAB
0D36 FD7E07    3245   MGETN1:  LD   A,(IY+CBB)    ; ENTRY COMPLETE?
0D39 A9        3246            XOR  C
0D3A E63F      3247            AND  3FH
0D3C C8        3248            RET  Z             ; QUIT IF SO
0D3D 21360D    3249            LD   HL,MGETN1
0D40 E5        3250            PUSH HL
0D41           3251            SYSTEM RANGED      ; RANDOMIZE WHILE WE WAIT
0D41 FF        3251 +          RST  56
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

0D42 76        3251 +         DEFB RANGED
               3251 +         IF   RANGED.EQ.INTPC
               3251 +         ENDIF
0D43           3252           SYSSUK SENTRY
0D43 FF        3252 +         RST  56
0D44 43        3252 +         DEFB SENTRY+1
               3252 +         IF   SENTRY.EQ.INTPC
               3252 +         ENDIF
0D45 0B00      3253           DEFW NUMBAS
0D47           3254           SYSSUK DOIT
0D47 FF        3254 +         RST  56
0D48 45        3254 +         DEFB DOIT+1
               3254 +         IF   DOIT.EQ.INTPC
               3254 +         ENDIF
0D49 4C0D      3255           DEFW GNUMDO
0D4B C9        3256           RET                 ; NOTHIN - LOOP ON SENTRY
0D4C           3257  GNUMDO:  JMP  SKYD,MGETN6
0D4C 13        3257 +         DEFB SKYD
0D4D 7F0D      3257 +         DEFW MGETN6
               3257 +         IF   0
               3257 +         ENDIF
0D4F           3258           JMP  STO,MGETN2
0D4F 14        3258 +         DEFB STO
0D50 550D      3258 +         DEFW MGETN2
               3258 +         IF   0
               3258 +         ENDIF
0D52           3259           JMP  SPO,MGETN3
0D52 1C        3259 +         DEFB SPO
0D53 610D      3259 +         DEFW MGETN3
               3259 +         IF   0
               3259 +         ENDIF
               3260  ; TRIGGER ROUTINE
0D55 CB60      3261  MGETN2:  BIT  4,B            ; 0-1 TRANS?
0D57 C8        3262           RET  Z              ; NO - IGNORE
0D58 79        3263           LD   A,C
0D59 3C        3264           INC  A              ; ARE WE ALREADY IN POT MODE?
0D5A 283A      3265           JR   Z,MGETN9-$     ; YEP - JUMP TO EXIT
0D5C CB79      3266           BIT  7,C            ; POT LEGAL?
0D5E C0        3267           RET  NZ             ; NO - IGNORE
0D5F 0EFF      3268           LD   C,0FFH         ; SET POT FLAG
               3269  ; POT ROUTINE
0D61 79        3270  MGETN3:  LD   A,C            ; QUIT IF NOT IN POT MODE
0D62 3C        3271           INC  A
0D63 C0        3272           RET  NZ
               3273  ; HOW MANY DIGITS?
0D64 D9        3274           EXX                 ; TO NORMAL SET
0D65 78        3275           LD   A,B            ; SNATCH DIGITS
0D66 D9        3276           EXX
0D67 FE01      3277           CP   1              ; 1 PRAY TELL?
0D69 060A      3278           LD   B,10
0D6B 2802      3279           JR   Z,MGETN4-$     ; JUMP IF GOOD GUESS
0D6D 0664      3280           LD   B,100          ; WRONG!
0D6F DB1C      3281  MGETN4:  IN   A,(POT0)       ; GET CURRENT POT VALUE
0D71 57        3282           LD   D,A            ; RANGE IT
0D72 AF        3283           XOR  A
0D73 5F        3284           LD   E,A
0D74 67        3285           LD   H,A
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

0D75 19        3286  MGETN5:  ADD  HL,DE
0D76 CE00      3287           ADC  A,0            ; ADD EVERY CARRY TO AC
0D78 27        3288           DAA
0D79 10FA      3289           DJNZ MGETN5-$
0D7B D9        3290           EXX                 ; BACK TO NORMAL SET
0D7C 77        3291           LD   (HL),A
0D7D 1814      3292           JR   MGETN8-$
               3293  ; KEYBOARD ROUTINE
0D7F 0C        3294  MGETN6:  INC  C              ; POT MODE?
0D80 2004      3295           JR   NZ,MGETN7-$    ; JUMP IF NOT
0D82 CD990D    3296           CALL CLRNUM
0D85 0C        3297           INC  C              ; SET ONE DIGIT SO FAR
0D86 CBF9      3298  MGETN7:  SET  7,C            ; SET POT LOCKOUT
0D88           3299           SYSTEM KCTASC
0D88 FF        3299 +         RST  56
0D89 40        3299 +         DEFB KCTASC
               3299 +         IF   KCTASC.EQ.INTPC
               3299 +         ENDIF
0D8A FE3D      3300           CP   '='            ; EQUALS TYPED?
0D8C 2808      3301           JR   Z,MGETN9-$     ; QUIT IF EQUALS
0D8E E60F      3302           AND  0FH
0D90 D9        3303           EXX
0D91           3304           SYSTEM SHIFTU       ; SHIFT DIGIT UP
0D91 FF        3304 +         RST  56
0D92 60        3304 +         DEFB SHIFTU
               3304 +         IF   SHIFTU.EQ.INTPC
               3304 +         ENDIF
0D93 D5        3305  MGETN8:  PUSH DE
0D94           3306           SYSTEM DISNUM
0D94 FF        3306 +         RST  56
0D95 36        3306 +         DEFB DISNUM
               3306 +         IF   DISNUM.EQ.INTPC
               3306 +         ENDIF
               3307  ; ENTER HERE FOR EQUAL OR TRIGGER EXIT TO THROW OUT RETUR
0D96 D1        3308  MGETN9:  POP  DE
0D97 D9        3309           EXX                 ; BACK TO NORMAL
0D98 C9        3310           RET


               3312  ; SUBROUTINE TO CLEAR NUMBER
0D99 C5        3313  CLRNUM:  PUSH BC
0D9A D9        3314           EXX                 ; TO NORMAL SET
0D9B E5        3315           PUSH HL
0D9C 78        3316           LD   A,B
0D9D 3C        3317           INC  A
0D9E E63E      3318           AND  3EH
0DA0 1F        3319           RRA                 ;
0DA1 D9        3320           EXX                 ; BACK TO ALTERNATE SET
0DA2 4F        3321           LD   C,A
0DA3 AF        3322           XOR  A
0DA4 47        3323           LD   B,A
0DA5 D1        3324           POP  DE
0DA6           3325           SYSTEM FILL
0DA6 FF        3325 +         RST  56
0DA7 1A        3325 +         DEFB FILL
               3325 +         IF   FILL.EQ.INTPC
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

               3325 +         ENDIF
0DA8 C1        3326           POP  BC
0DA9 C9        3327           RET


               3329  ; NAME:           SHIFT UP
               3330  ; INPUT:          A = DATA TO SHIFT UP
               3331  ;                 B = SIZE IN DIGITS
               3332  ;                 HL = AREA TO SHIFT ADDRESS
0DAA F5        3333  MSHFTU: PUSH AF
0DAB 78        3334           LD   A,B
0DAC 3C        3335           INC  A
0DAD E63E      3336           AND  3EH
0DAF 47        3337           LD   B,A
0DB0 F1        3338           POP  AF
0DB1 ED6F      3339  SHFTU1:  RLD
0DB3 23        3340           INC  HL
0DB4 10FB      3341           DJNZ SHFTU1-$
0DB6 C9        3342           RET




0DB7 454E5445 3344  ENTSTG:  DEFM 'ENTER '
0DBD 00        3345           DEFB 0
0DBE FA01      3346  CML:     DEFW CALCL
0DC0 D30D      3347           DEFW PNCM
0DC2 2813      3348           DEFW CMSTRT         ; CHECKMATE START
0DC4 0000      3349  SCBL:    DEFW 0
0DC6 E80D      3350           DEFW PNSCB
0DC8 190E      3351           DEFW SCBST
0DCA 47554E46 3352  PNGF:    DEFM 'GUNFIGHT'
0DD2 00        3353           DEFB 0
0DD3 43484543 3354  PNCM:    DEFM 'CHECKMATE'
0DDC 00        3355           DEFB 0
0DDD 43414C43 3356  PNCALC:  DEFM 'CALCULATOR'
0DE7 00        3357           DEFB 0
0DE8 53435249 3358  PNSCB:   DEFM 'SCRIBBLING'
0DF2 00        3359           DEFB 0
0DF3 53454C45 3360  GAMSTR:  DEFM 'SELECT GAME'
0DFE 67        3361           DEFB 67H
0DFF 08        3362           DEFB 8
0E00 58        3363           DEFB 88
0E01 0D        3364           DEFB 1101B
0E02 28432920 3365           DEFM '(C) BALLY MFG 1977'
0E14 00        3366           DEFB 0
0E15           3367           END

TOTAL ASSEMBLER ERRORS =
```

CROSS REFERENCE

LABEL	VALUE	REFERENCE							
A0	00E1	-509							
A1	0070	-521							
A2	0037	-533							
A3	001B	-545							
A4	000D	-557							
A5	0006	-563							
ACTINT	000E	-226	227	3040	3040	3084			
AKEYS	0214	-1123	1075	3041					
ALKEYS	0214	-50							
AS0	00D4	-510							
AS1	006A	-522							
AS2	0034	-534							
AS3	001A	-546							
B0	00C8	-511							
B1	0064	-523							
B2	0031	-535							
B3	0018	-547							
BCDAD	0321	-1315	942						
BCDADD	0062	-278	279						
BCDCHS	006A	-282	283	1324	1324	1333	1333		
BCDCS	0364	-1391	946						
BCDD0	0BEE	-2872	2994						
BCDD1	0BFD	-2881	2980	2982					
BCDD2	0C05	-2885	2996						
BCDD3	0C0B	-2888	2990						
BCDD4	0C11	-2891	2984						
BCDDIV	0068	-281	282						
BCDDV	0284	-1208	945						
BCDISP	0BEB	-2870	920	2950					
BCDML	02DE	-1268	944						
BCDMUL	0066	-280	281						
BCDNEG	006C	-283	284	1334	1334	1336	1336		
BCDNG	0341	-1350	947						
BCDNG1	034D	-1359	1388						
BCDSB	031F	-1316	943						
BCDSUB	0064	-279	280						
BEGRAM	4FCE	-595	640	3067	3069				
BITSPL	00A0	-44							
BLANK	002A	-244	245						
BMUSIC	0012	-230	231						
BYTEPL	0028	-43	1506	2169	2248	2270	2289	2311	2348
		2377	2611	3214	3217	3218			
C1	00BD	-512							
C2	005E	-524							
C3	002E	-536							
C4	0017	-548							
C5	000B	-558							
C6	0005	-564							
C7	0002	-567							
CALCL	01FA	-1099	3346						
CALCST	1020	-652	1101						
CBA	0009	-124	774	1080	1089	2129	2729	2932	
CBB	0007	-122	842	1090	3245				

CBC	0006	-121	843	1405	2032	2510	2557	2588	2949
CBD	0005	-120	775	2497	2499	2529	2784	3173	
CBE	0004	-119	776	2530	2606	2783	3172		
CBFLAG	0008	-123	1443	2028	2069				
CBH	000B	-126	768	1270	2933				
CBIXH	0003	-118	770	870					
CBIXL	0002	-117	771	867					
CBIYH	0001	-116							
CBIYL	0000	-115							
CBL	000A	-125	769	1271	2934				
CCT1	03E6	-1516	1537						
CCTLP	03DD	-1509	1538						
CHDOWN	0001	-112							
CHLEFT	0002	-111							
CHRDIS	0032	-249	250	3121	3121	3123	3123	3151	3151
CHRIGH	0003	-110							
CHTRIG	0004	-109							
CHUP	0000	-113							
CKSUM1	0033	-711							
CKSUM2	0B0E	-2698							
CLRNUM	0D99	-3147	3243	3296					
CML	0DBE	-3178	1129						
CMPIT	0C22	-2907	3008						
CMPLOP	0C30	-2915	3028						
CMSTRT	1328	-651	3348						
CNT	4FDD	-612	1547	1675	1677				
COL0L	0004	-169							
COL0R	0000	-165							
COL1L	0005	-170							
COL1R	0001	-166							
COL2L	0006	-171							
COL2R	0002	-167							
COL3L	0007	-172							
COL3R	0003	-168							
COLBX	000B	-173	1072	1084					
COLLST	4FE8	-623	1082	1083					
COLSET	0018	-235	236	3082					
CONC1	0264	-1169	1159						
CONC2	002B	-705	1171						
CONCM	0008	-190	662						
CONCPL	0256	-1158	1144	1153					
CS1	00B2	-513							
CS2	0059	-525							
CS3	002C	-537							
CS4	0015	-549							
CS5	000A	-559							
CT0	4FD5	-603	1660						
CT1	4FD6	-604							
CT2	4FD7	-605							
CT3	4FD8	-606							
CT4	4FD9	-607							
CT5	4FDA	-608							
CT6	4FDB	-609							
CT7	4FDC	-610							
CTIMER	0203	-47							
CTLP	03D9	-1507	1549	1552					
D1	00A8	-514							

D2	0054	-526							
D3	0029	-538							
D4	0014	-550							
DABS	0072	-286	287	1257	1257	1259	1259		
DADD	006E	-284	285	1233	1233	1243	1243	1288	1288
		1338	1338						
DCLCT1	0849	-2494	2519						
DCLCTB	083E	-2486	2527	2586					
DECCTS	0010	-227	229						
DELOAD	0074	-775	1580	2587					
DISC1A	07F1	-2441	2470						
DISC1B	07FE	-2448	2464						
DISCH1	07ED	-2439	2461						
DISCH2	080A	-2453	2481						
DISCH3	080D	-2454	2479						
DISCH4	0821	-2466	2500						
DISCH5	0839	-2479	2471						
DISNUM	0036	-251	253	3307	3307				
DISPCH	07E1	-2433	918	2405	2955	2992			
DISTIM	0052	-268	269						
DIV1	029F	-1229	1248						
DIV2	02A3	-1230	1236						
DIV3	02B1	-1237	1233						
DIV4	0315	-1307	1251						
DOIT	0044	-261	262	3255	3255				
DOITB	0046	-262	263						
DS1	009F	-515							
DS2	004F	-527							
DS3	0027	-539							
DS4	0013	-551							
DS5	0009	-560							
DS6	0004	-565							
DSMG	0070	-285	286						
DURAT	4FEA	-625	1691	1804	1911	1923			
E1	0096	-516							
E2	004A	-528							
E3	0025	-540							
E4	0012	-552							
EMUSIC	0014	-231	233	3077					
END	00C0	-380							
ENDSCR	4FF4	-633	3017						
ENTSTG	0DB7	-3176	3198						
EPLOP	0410	-1543	1560						
ETLP	0493	-1648	1663	1666					
F1	008D	-517							
F2	0046	-529							
F3	0022	-541							
F4	0011	-553							
F5	0008	-561							
FILL	001A	-236	237	3069	3069	3213	3213	3217	3217
		3326	3326						
FINDL3	0CF4	-3040	1076	2467	2502	2920			
FIRSTC	2000	-41	3064	3066	3086				
FNTSML	020D	-49							
FNTSYS	0206	-48							
FS1	0085	-518							
FS2	0042	-530							

FS3	0020	-542							
FS4	0010	-554							
FTBASE	0000	-94	2472						
FTBYTE	0003	-97	2476	2494	2546				
FTFSX	0001	-95	2531						
FTFSY	0002	-96	2537						
FTPTH	0006	-100	2482						
FTPTL	0005	-99	2483						
FTYSIZ	0004	-98	2477	2489					
G0	00FD	-507							
G1	007E	-519							
G2	003E	-531							
G3	001F	-543							
G4	000F	-555							
G5	0007	-562							
G6	0003	-566							
G7	0001	-568							
G8	0000	-569							
GAMSTB	4FF8	-635	1752	3014	3023				
GAMSTR	0DF3	-3192	3085						
GETNUM	004E	-266	267	3143	3143	3207	3207		
GETPAR	004C	-265	266						
GFSTRT	17DE	-650	1131						
GMOVR	0C57	-2937	3038						
GNACC	02C0	-1245	1208	1280					
GNUMDO	0D4C	-3103	3255						
GOUT	0502	-1732	1715	1747	1751	1754			
GS0	00EE	-508							
GS1	0077	-520							
GS2	003B	-532							
GS3	001D	-544							
GS4	000E	-556							
GSBEND	0007	-63	1755	3024					
GSBSCR	0001	-62	3015						
GSBTIM	0000	-61	1753						
GTO1	04F4	-1724	1740						
GTO2	04F9	-1728	1736						
GTIMER	04E0	-1708	1724						
GTMINS	4FEE	-629	2947						
GTSECS	4FED	-628	2957						
GUNLNK	0218	-1129	3091						
HANDLE	0453	-1590	1606						
HORAF	000F	-196							
HORCB	0009	-174	1515						
HUMANR	0040	-258	259						
INCLOP	0C18	-2900	3010						
INCSCR	0054	-269	271						
INDEXB	005C	-275	276						
INDEXN	0056	-272	273						
INDEXW	005A	-274	275						
INFBK	000D	-187	1045						
INLIN	000F	-189	1043						
INMOD	000E	-188	1519						
INTPC	0000	-217	218	1232	1233	1242	1243	1257	1259
		1288	1324	1333	1334	1336	1338	3035	3040
		3041	3069	3076	3076	3076	3093	3121	3123
		3126	3143	3151	3195	3201	3207	3208	3213

		3217	3224	3252	3253	3255	3300	3305	3307
		3326							
INTPE	004E	-754	844						
INTP@	0000	-2963	-2967						
INTST	0008	-194							
INXNIB	0B76	-2745	936						
ITAB	0034	-713	1040	1044					
JOYS	0471	-1610	1624						
KCTASC	0040	-259	260	3300	3300				
KCTATB	0AD5	-2640	2726						
KEY0	0014	-207							
KEY1	0015	-208							
KEY2	0016	-209							
KEY3	0017	-210	1582						
KEYSEX	4FE3	-618	1570	1719					
LRGCHR	08E4	-2610	1113						
M81	053A	-1791	1826						
M815	0540	-1794	1824						
M82	0547	-1798	1816						
M83	054B	-1801	1819	1821					
MACTIN	018B	-1034	713	900					
MAGIC	000C	-191	2127	2556	2616	2788			
MATH	0056	-271	272						
MBLAN1	07A3	-2328	2358						
MBLAN2	07A4	-2329	2355						
MBLANK	079E	-2324	914						
MCALL	0006	-220	221						
MCOLOR	01DB	-1083	905						
MDISTI	0BCC	-2840	934						
MDO1A	061C	-1935							
MDOIT	060C	-1923	927						
MDOIT0	060E	-1925	1961						
MDOIT1	0616	-1931	1952						
MDOIT2	0620	-1938	1958						
MDOIT3	0621	-1939							
MDOITB	060B	-1922	928						
MENTRY	01AC	-1062	926						
MENU	004A	-264	265	3093	3093				
MENUCL	0013	-676	3082						
MENUST	0218	-51							
MFILL	0AEE	-2672	906						
MFILL1	0AEF	-2673	2767						
MFROG	0B06	-2693	2850						
MGETN	0D31	-3094	932						
MGETN1	0D36	-3097	3249						
MGETN2	0D55	-3101	3259						
MGETN3	0D61	-3110	3260						
MGETN4	0D6F	-3121	3279						
MGETN5	0D75	-3126	3289						
MGETN6	0D7F	-3134	3258						
MGETN7	0D86	-3138	3295						
MGETN8	0D93	-3141	3292						
MGETN9	0D96	-3142	3265	3301					
MGETP	0CFB	-3058	931						
MINCSC	0C15	-2898	935						
MINDB	0BBD	-2824	939						
MINDB1	0BC5	-2829	2921						

MINDW	0BAC	-2807	938	
MINT0	0084	-828	753	
MINT1	0095	-837	835	
MINT2	009A	-840	830	
MINTPC	007B	-814	893	
MJUMP	000A	-222	223	
MKCTAS	0AC9	-2631	925	
MMCALL	007D	-824	896	1968
MMENU	0C97	-2992	930	
MMENU1	0CA2	-2996	3136	
MMENU3	0CC8	-3012	3151	
MMENU5	0CD9	-3019	3146	
MMENU6	0CDF	-3020	3148	
MMENU7	0CE2	-3023	3159	
MMJUMP	0AC4	-2622	898	
MMOVE	0B4B	-2701	940	
MMRET	0B73	-2740	897	
MMTD	0240	-1144	956	
MMTD1	024E	-1152	1150	
MMTD2	024F	-1153	1147	
MNCLR	0D19	-3070	3114	3193
MNGH	0005	-2951		
MNGL	0004	-2950		
MNNH	0001	-2947	3131	
MNNL	0000	-2946	3132	
MNSAH	0003	-2949	3123	
MNSAL	0002	-2948	3124	
MO0	055B	-1809	1802	
MO01	056B	-1818	1837	
MO1	0574	-1823	1834	
MO2	057D	-1828	1847	
MO3	0587	-1834	1853	
MO4	0594	-1841	1859	
MO40	05A1	-1848	1865	
MO41	05A5	-1850	1867	
MO43	05B7	-1858	1876	
MO44	05C0	-1865	1902	
MO45	05C5	-1867	1857	
MO5	05CC	-1870	1873	
MO6	05DA	-1879	1895	
MO61	05E6	-1884	1903	
MOVE	005E	-276	277	
MPAINT	06B2	-2099	907	
MPAUSE	001B	-687	933	
MPIZBK	01BA	-1068	929	1079
MPT1	06C5	-2112	2140	
MPT2	06CF	-2117	2137	
MPT3	06D5	-2122	2151	
MPT4	06DE	-2128	2147	
MQUIT	0C41	-2930	953	
MQUIT1	0C4A	-2932	3045	
MQUIT2	0C56	-2936	3043	
MRANGE	037F	-1425	952	
MRARGT	014B	-968	833	
MRCALL	0632	-1952	895	1970
MRELA1	0AFB	-2689	922	
MRELA2	0B00	-2691	2779	

MRELAB	0AF6	-2686	921	2231	
MREST	07AD	-2340	916		
MREST1	07B5	-2347	2381		
MRET	0008	-221	222		
MRFLOP	0006	-102	1146	2235	2330
MRLOCK	4FF7	-634			
MROR	0004	-104			
MRROT	0002	-106			
MRSHFT	0003	-107			
MRXOR	0005	-103			
MRXPND	0003	-105	2237	2276	
MSAVE	03B9	-1469	915		
MSAVE1	03C2	-1477	1509		
MSCRL1	026B	-1179	1189		
MSCROL	026A	-1178	917		
MSENK2	043B	-1570	1586	1596	
MSENKE	0446	-1579	1593		
MSETB	036C	-1398	954		
MSETUP	03CF	-1491	904		
MSETW	0023	-697	955		
MSHFTU	0DAA	-3165	941		
MSK1	042C	-1560	1590		
MSKTD	007E	-292			
MSUCK	00A4	-857	899		
MSUCK1	00A8	-863	839	2412	
MSUCK2	00B6	-871	864		
MSUCK3	00BF	-879	886		
MSUCK5	00C6	-884	880		
MULT1	02CD	-1251	1264		
MULT2	02E1	-1269	1296		
MULT3	02E8	-1275	1291		
MULT4	02F0	-1279	1285		
MULT5	0309	-1298	1314		
MULT6	031B	-1308	1240	1322	1325
MULT7	0313	-1305	1316		
MUZ999	05F4	-1893	1832		
MUZAK	0012	-229	230		
MUZCP1	0517	-1774	1768		
MUZCPU	0514	-1773	1699		
MUZPC	4FCE	-597	1797	1917	
MUZSET	0508	-1741	902		
MUZSP	4FD0	-598	1766	1798	1918
MUZSTP	05FC	-1898	903	1767	1909
MVBLA1	079A	-2315	2331		
MVBLAN	077D	-2301	913		
MVCT1A	066F	-2047	2068		
MVECT	0633	-2004	924		
MVECT1	0665	-2040	2065		
MVECT2	0684	-2062	2080	2082	
MVECT3	06A4	-2082	2085		
MVECT6	06A6	-2084	2072		
MVECTC	0656	-2033	923	2039	
MVWRIT	06FE	-2174	908		
MWRIT	0719	-2207	911		
MWRITA	071C	-2211	912		
MWRITP	0715	-2200	910		
MWRITR	070B	-2184	909		

MWRT	0725	-2217	2252				
MWRTFL	074C	-2252	2236				
MWX	0735	-2231	2238				
MWX1	0736	-2232	2273				
MWX2	0739	-2235	2265				
MWXF	0766	-2272	2277				
MWXF1	0767	-2273	2314				
MWXF2	076A	-2276	2306				
MXINTC	0279	-1194	894				
MXSCR	021E	-52					
NEGT	0074	-287	288	1232	1232	1242	1242
NOGAME	0235	-54					
NOLINE	0060	-2945	3078	3218			
NOPLAY	0228	-53					
NORMEM	4000	-40	3213	3217			
NUMBAS	000B	-669	3253				
NUMPLY	4FF3	-632					
NWHDWR	0001	-37	2836				
NXTFR1	0858	-2507	2532				
NXTFR2	0863	-2513	2538				
NXTFR3	086A	-2517	2534				
NXTFRM	084E	-2503	2466	2487			
OA1	008F	-577					
OA2	0047	-578					
OA3	0023	-579					
OA4	0011	-580					
OA5	0008	-581					
OBO	00FE	-571					
OCO	00F1	-572					
OD1	00D6	-573					
OE1	00BF	-574					
OF1	00B4	-575					
OG1	00A0	-576					
OPLOOP	051B	-1775	1841	1846	1851	1864	
OPLP2	0592	-1840	1871	1881	1888	1893	1907
OPOTO	4FDF	-614					
OPOT1	4FE0	-615					
OPOT2	4FE1	-616					
OPOT3	4FE2	-617					
OSWO	4FE4	-619					
OSW1	4FE5	-620					
OSW2	4FE6	-621					
OSW3	4FE7	-622					
PAWS	0050	-267	268	3208	3208		
PBLP	01C7	-1075					
PFUG	0008	-649	1559				
PHOT	040B	-1538	1558				
PIZBRK	0048	-263	264				
PNCALC	0DDD	-3188	1100				
PNCM	0DD3	-3186	3347				
PNGF	0DCA	-3184	1130				
PNSCB	0DE8	-3190	3350				
POTO	001C	-202	1093	1553	3281		
POT1	001D	-203					
POT2	001E	-204					
POT3	001F	-205					
PRIOR	4FF9	-636	1685	1756	1904	1906	1924

PSWCY	0000	-59					
PSWPV	0002	-58					
PSWSGN	0007	-56					
PSWZRO	0006	-57	2028	2069			
PUSH1	005D	-763	761				
PUTNB1	0BA5	-2794	2889				
PUTNB2	0BA8	-2796	2897				
PUTNIB	0B90	-2778	937				
PVOLAB	4FD2	-599	1828	1861			
PVOLMC	4FD3	-600	1830				
PWRUP	0C61	-2954	663				
PWRUP1	0C95	-2974	3090				
QFROG	0AD1	-2637	1474	2785			
QUIT	0078	-289	290				
R1	03A2	-1445	1473				
R2	03A6	-1448	1470				
R3	03A9	-1450	1467				
RANGED	0076	-288	289	3252	3252		
RANSHT	4FEF	-631	1450	1455	1456	1460	
RCALL	0004	-219	220				
RECTAN	001C	-237	238				
RELAB1	003A	-254	255				
RELABS	0038	-253	254				
RELD	0068	-770	2413				
RELTA	0B08	-2695	2592	2778			
RELTA1	0B4E	-2705	2124	2781	2787		
RELTA2	0B56	-2711					
RELTA3	0B5F	-2717	2818				
RENTER	007C	-815	827				
REPEAT	0C3B	-2922	3021				
RESTOR	002E	-246	247				
RETN	027A	-1197	751				
SAVE	002C	-245	246				
SCBL	0DC4	-3181	1099				
SCBST	0E19	-653	3351				
SCHEDR	000C	-225	226				
SCREEN	0000	-42					
SCROLL	0030	-247	249				
SCRSTR	0016	-233	234				
SCT0	0001	-129					
SCT1	0002	-130					
SCT2	0003	-131					
SCT3	0004	-132					
SCT4	0005	-133					
SCT5	0006	-134					
SCT6	0007	-135					
SCT7	0008	-136					
SDABS	0356	-1374	950				
SDADD	036E	-1408	948				
SDADD1	036F	-1409	1439				
SDSMG	0329	-1323	949				
SDSMG1	0333	-1331	1360				
SEMI4S	4FDE	-613					
SENFLG	4FFA	-637	1062				
SENTRY	0042	-260	261	3041	3041	3253	3253
SETB	007A	-290	291				
SETEND	0C35	-2919	3029				

SETOUT	0016	-234	235	3078					
SETW	007C	-291	292						
SF0	0009	-137							
SF1	000A	-138							
SF2	000B	-139							
SF3	000C	-140							
SF4	000D	-141							
SF5	000E	-142							
SF6	000F	-143							
SF7	0010	-144							
SH1	03B1	-1455	1482						
SHFTU1	0DB1	-3171	3341						
SHIFTR	03AC	-1451	1451	1458					
SHIFTU	0060	-277	278	3305	3305				
SIXY	04CC	-1689	1694	1702	1706	1709			
SJ0	0015	-153							
SJ1	0017	-155							
SJ2	0019	-157							
SJ3	001B	-159							
SKYD	0013	-146	1091	1602	3044	3258			
SKYU	0012	-147	1592						
SMLCHR	0ABF	-2620	1120						
SMLFNT	020D	-1115	2945						
SNDBX	0018	-185	1806	1839	1925				
SNEGT	034C	-1358	951						
SNUL	0000	-128							
SP0	001C	-148	3260						
SP1	001D	-149							
SP2	001E	-150							
SP3	001F	-151							
SSEC	0011	-145	1576						
ST0	0014	-152	3042	3259					
ST1	0016	-154							
ST2	0018	-156							
ST3	001A	-158							
STAK0	04BE	-1679	1696						
STHLDE	0BB8	-2816	1155						
STIMER	0200	-46							
STOREN	0058	-273	274						
STRD1	07CE	-2381	2402						
STRD2	07D4	-2384	2404						
STRDIS	0034	-250	251	3035	3035	3126	3126	3195	3195
		3201	3201	3224	3224				
STRIPE	06E2	-2134	2139	2152					
STRNEW	07C4	-2375	919	2407	2414				
STRP1	06EB	-2139	2174						
SUCK	000C	-223	225						
SW0	0010	-198	1614						
SW1	0011	-199							
SW2	0012	-200							
SW3	0013	-201							
SWHIT	0461	-1599	1618						
SWLOP	0456	-1591	1620						
SYSDPT	00CB	-893	756						
SYSFNT	0206	-1108	2462						
SYSRAM	4FCE	-640							
TIMEX	047B	-1625	1106						

TIMEY	047E	-1635	901	1048			
TIMEZ	04A0	-1660	1046	1105			
TIMLP	0485	-1638	1674				
TIMOUT	4FEC	-627	1065	1096	3074		
TKEYS	0421	-1555	1573				
TMR60	4FEB	-626					
TONEA	0011	-178					
TONEB	0012	-179					
TONEC	0013	-180					
TONMO	0010	-177					
TPLOP	03FF	-1530	1568				
TRCHK	03EC	-1522	1088				
TSEX	0413	-1546	1546				
TTEST	01E5	-1088	1067	1077			
UMARGT	4FFB	-638	836				
UPISTR	0000	-216	217				
USERTB	4FFD	-639	762				
VBBLNK	0006	-88	2201	2325	2327		
VBCCHK	0004	-85	2071	2090	2093	2111	
VBCH	0003	-84	2060	2088	2109		
VBCL	0002	-83	2061	2089	2108		
VBCLAT	0003	-92	2090	2111			
VBCLMT	0000	-90	2071				
VBCREV	0001	-91	2093				
VBDCH	0001	-82	2058	2104			
VBDCL	0000	-81	2059	2103			
VBDXH	0004	-69					
VBDXL	0003	-68	2037	2040			
VBDYH	0009	-74					
VBDYL	0008	-73	2040				
VBLANK	0028	-243	244				
VBMR	0000	-65	2198	2330			
VBOAH	000E	-79	2328				
VBOAL	000D	-78	2329				
VBSACT	0007	-87	2029				
VBSTAT	0001	-66	2029	2201	2325	2327	
VBTIMB	0002	-67	2030	2031			
VBXCHK	0007	-72					
VBXH	0006	-71	2200				
VBXL	0005	-70					
VBYCHK	000C	-77					
VBYH	000B	-76	2199				
VBYL	000A	-75					
VECT	003E	-256	258				
VECTC	003C	-255	256				
VERAF	000E	-195					
VERBL	000A	-175					
VIBRA	0014	-181					
VOICES	4FD4	-601	1765	1805	1850		
VOLAB	0016	-182	1071	1711	1829	1914	
VOLC	0015	-183	1070	1712	1831	1915	
VOLN	0017	-184					
VWRITR	001E	-238	239				
WASTE	0FFF	-586	587	2160	2161	3072	
WASTER	0FFF	-587					
WRFL1	0751	-2255	2293				
WRFL2	0754	-2258	2285				

WRIT	0024	-241	242	
WRITA	0026	-242	243	
WRITP	0022	-240	241	
WRITR	0020	-239	240	
WRTL1	088D	-2538	2584	
WRTL2	0898	-2546	2576	
WRTL3	08AC	-2562	2559	
WRTL4	08BF	-2570	2617	
WRTL5	08C4	-2575	2605	
WRTL6	08D4	-2586	2608	
WRTLIN	086C	-2522	2492	
XINTC	0002	-218	219	3085
XNIB	0B7B	-2756	2849	2979
XNIB1	0B8C	-2769	2868	
XPAND	0019	-192	2554	2589
XPNDON	0001	-36		

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

                641
                642             LIST S,X,M,T
                643   ; **********
                644   ; * SKETCH *
                645   ; **********
                646   ;
                647   ;THE OFFICIAL NAME OF THIS
                648   ;PROGRAM IS SCRIBBLING
                649   ;
                650   ; SKETCH EQUATES
                651   ; SKETCH PACKET DISPLACEMENTS:
>001E           652   SCPSIZ   EQU  30            ; SIZE OF SKETCH PACKET
>0000           653   SCSAVA   EQU  0             ; SAVE AREA START
>001A           654   SCXC     EQU  26            ; X COORDINATE
>001B           655   SCYC     EQU  27            ; Y COORDINATE
>001C           656   SCSADL   EQU  28            ; SAVE ADDRESS LO AND HI
>001D           657   SCSADH   EQU  29
                658   ; OTHER GOODIES
>0004           659   MOVTMR   EQU  4             ; MOVE RATE
>0014           660   KSCTRV   EQU  20            ; COLOR STEPPING TIME
                661            ORG  0E19H         ; ** START
 0E19           662   BEGIN:   SYSSUK GETPAR
 0E19 FF        662 +          RST  56
 0E1A 4D        662 +          DEFB GETPAR+1
                662 +          IF   GETPAR.EQ.INTPC
                662 +          ENDIF
 0E1B 2802      663            DEFW NOPLAY
 0E1D 01        664            DEFB 1
 0E1E F34F      665            DEFW NUMPLY
 0E20           666   SCCLR:
 0E20 31E84E    667            LD   SP,SCRSTK
 0E23           668            SYSTEM INTPC
 0E23 FF        668 +          RST  56
 0E24 00        668 +          DEFB INTPC
                668 +          IF   INTPC.EQ.INTPC
>0001           668 +INTP@     DEFL 1
                668 +          ENDIF
 0E25           669            DO   FILL          ; CLEAR SCREEN
 0E25 1B        669 +          DEFB FILL+1
 0E26 0040      670            DEFW NORMEM
 0E28 600E      671            DEFW 92*BYTEPL
 0E2A 00        672            DEFB 0
 0E2B           673            DO   FILL
 0E2B 1B        673 +          DEFB FILL+1
 0E2C F04E      674            DEFW P1SCP
 0E2E 7800      675            DEFW SCPSIZ*4
 0E30 00        676            DEFB 0
 0E31           677            DO   SETOUT
 0E31 17        677 +          DEFB SETOUT+1
 0E32 B8        678            DEFB 184
 0E33 28        679            DEFB 40
 0E34 08        680            DEFB 8
 0E35           681            DO   MOVE
 0E35 5F        681 +          DEFB MOVE+1
 0E36 E84E      682            DEFW COLORS
 0E38 0800      683            DEFW 8
 0E3A 0C10      684            DEFW INICOL
```

```
ADDR OBJECT   STMT  LABEL    OPCD OPERAND      COMMENT

0E3C           685           DO   COLSET
0E3C 19        685 +         DEFB COLSET+1
0E3D E84E      686           DEFW COLORS
0E3F           687           DO   SETW
0E3F 7D        687 +         DEFB SETW+1
0E40 46        688           DEFB 70
0E41 24        689           DEFB 36
0E42 0A4F      690           DEFW P1SCP+SCXC
0E44           691           DO   SETW
0E44 7D        691 +         DEFB SETW+1
0E45 53        692           DEFB 83
0E46 24        693           DEFB 36
0E47 284F      694           DEFW P2SCP+SCXC
0E49           695           DO   SETW
0E49 7D        695 +         DEFB SETW+1
0E4A 46        696           DEFB 70
0E4B 30        697           DEFB 48
0E4C 464F      698           DEFW P3SCP+SCXC
0E4E           699           DO   SETW
0E4E 7D        699 +         DEFB SETW+1
0E4F 53        700           DEFB 83
0E50 30        701           DEFB 48
0E51 644F      702           DEFW P4SCP+SCXC
0E53           703           DO   SETB
0E53 7B        703 +         DEFB SETB+1
0E54 04        704           DEFB MOVTMR
0E55 D54F      705           DEFW CTO
0E57           706           DONT XINTC
0E57 02        706 +         DEFB XINTC
0E58 21580E    707  MAINLP:  LD   HL,MAINLP
0E5B E5        708           PUSH HL
0E5C           709           SYSSUK SENTRY
0E5C FF        709 +         RST  56
0E5D 43        709 +         DEFB SENTRY+1
               709 +         IF   SENTRY.EQ.INTPC
               709 +         ENDIF
0E5E 650E      710           DEFW KEYMES
0E60           711           SYSSUK DOIT
0E60 FF        711 +         RST  56
0E61 45        711 +         DEFB DOIT+1
               711 +         IF   DOIT.EQ.INTPC
               711 +         ENDIF
0E62 A10E      712           DEFW SCDOTB
0E64 C9        713           RET
0E65 2F        714  KEYMES:  DEFB 2FH
0E66 0F        715           DEFB 0FH
0E67 0F        716           DEFB 0FH
0E68 0F        717           DEFB 0FH
               718  ; KEYBOARD HANDLER
0E69 05        719  KEYBO:   DEC  B
0E6A 0E03      720           LD   C,3
0E6C 78        721           LD   A,B
0E6D FE14      722           CP   20           ; CLEAR ENTRY DOWN?
0E6F 28AF      723           JR   Z,SCCLR-$    ; JUMP TO CLEAR IF SO
0E71 0F        724           RRCA
0E72 0F        725           RRCA
0E73 A1        726           AND  C
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

0E74           727            SYSSUK INDEXB
0E74 FF        727 +          RST   56
0E75 5D        727 +          DEFB INDEXB+1
               727 +          IF    INDEXB.EQ.INTPC
               727 +          ENDIF
0E76 290F      728            DEFW CDELTB
0E78 EB        729            EX    DE,HL
0E79 78        730            LD    A,B
0E7A A1        731            AND   C
0E7B 67        732            LD    H,A
0E7C 79        733            LD    A,C
0E7D 94        734            SUB   H
0E7E           735            SYSSUK INDEXB        ; POINT AT COLOR
0E7E FF        735 +          RST   56
0E7F 5D        735 +          DEFB INDEXB+1
               735 +          IF    INDEXB.EQ.INTPC
               735 +          ENDIF
0E80 E84E      736            DEFW COLORS
0E82 1A        737            LD    A,(DE)
0E83 86        738            ADD   A,(HL)         ; ADD DELTA FACTOR
0E84 CB58      739            BIT   3,B            ; WAS KEY FOR INTENSITY?
0E86 2804      740            JR    Z,KEYB1-$
0E88 AE        741            XOR   (HL)
0E89 E607      742            AND   7
0E8B AE        743            XOR   (HL)
0E8C 77        744   KEYB1:   LD    (HL),A
0E8D 23        745            INC   HL             ; CHANGE COLOR ON OTHER SIDE
0E8E 23        746            INC   HL
0E8F 23        747            INC   HL
0E90 23        748            INC   HL
0E91 77        749            LD    (HL),A
0E92           750            SYSSUK COLSET
0E92 FF        750 +          RST   56
0E93 19        750 +          DEFB COLSET+1
               750 +          IF    COLSET.EQ.INTPC
               750 +          ENDIF
0E94 E84E      751            DEFW COLORS
0E96 3E14      752            LD    A,KSCTRV       ; SET KEYSEX CLEAR TIMER
0E98 32D64F    753            LD    (CT1),A
0E9B C9        754            RET
               755   ; ROUTINE TO CLEAR KEYSEX
0E9C AF        756   KLRKSX:  XOR   A
0E9D 32E34F    757            LD    (KEYSEX),A
0EA0 C9        758            RET
0EA1           759   SCDOTB:  JMP   SCTO,DOWRTS
0EA1 01        759 +          DEFB SCTO
0EA2 D30F      759 +          DEFW DOWRTS
               759 +          IF    0
               759 +          ENDIF
0EA4           760            JMP   SCT1,KLRKSX
0EA4 02        760 +          DEFB SCT1
0EA5 9C0E      760 +          DEFW KLRKSX
               760 +          IF    0
               760 +          ENDIF
0EA7           761            JMP   SKYD,KEYB0
0EA7 13        761 +          DEFB SKYD
0EA8 690E      761 +          DEFW KEYB0
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

               761 +          IF   0
               761 +          ENDIF
               762  ; ITERATE THROUGH ACTIVE PLAYERS SUBROUTINE
0EAA DD21F04E  763  ITER4:    LD   IX,P1SCP
0EAE 3AF34F    764            LD   A,(NUMPLY)
0EB1 47        765            LD   B,A
0EB2 4F        766            LD   C,A
0EB3 C5        767  ITER41:   PUSH BC
0EB4 E5        768            PUSH HL
0EB5 11BA0E    769            LD   DE,ITRET
0EB8 D5        770            PUSH DE
0EB9 E9        771            JP   (HL)
0EBA 111E00    772  ITRET:    LD   DE,SCPSIZ
0EBD DD19      773            ADD  IX,DE
0EBF E1        774            POP  HL
0EC0 C1        775            POP  BC
0EC1 10F0      776            DJNZ ITER41-$
0EC3 C9        777            RET
               778  ; UPDATE COORDINATES ROUTINE
0EC4 79        779  SCRUPD:   LD   A,C
0EC5 90        780            SUB  B
0EC6           781            SYSSUK INDEXB
0EC6 FF        781 +          RST  56
0EC7 5D        781 +          DEFB INDEXB+1
               781 +          IF   INDEXB.EQ.INTPC
               781 +          ENDIF
0EC8 E44F      782            DEFW OSWO
0ECA E60F      783            AND  0FH
0ECC CD0110    784            CALL GETDLT          ; GET DELTAS
0ECF DD7E1A    785            LD   A,(IX+SCXC)     ; UPDATE X
0ED2 82        786            ADD  A,D
0ED3 FE98      787            CP   152             ; OUT OF BOUNDS?
0ED5 3003      788            JR   NC,SCRUP1-$
0ED7 DD771A    789            LD   (IX+SCXC),A
0EDA DD7E1B    790  SCRUP1:   LD   A,(IX+SCYC)     ; SAME FOR Y
0EDD 84        791            ADD  A,H
0EDE FE55      792            CP   85
0EE0 D0        793            RET  NC
0EE1 DD771B    794            LD   (IX+SCYC),A
0EE4 C9        795            RET
               796  ; RESTORE
0EE5 DDE5      797  SCREST:   PUSH IX
0EE7 D1        798            POP  DE
0EE8 1A        799            LD   A,(DE)
0EE9 A7        800            AND  A
0EEA C8        801            RET  Z
0EEB DD661D    802            LD   H,(IX+SCSADH)
0EEE DD6E1C    803            LD   L,(IX+SCSADL)
0EF1           804            SYSTEM RESTOR
0EF1 FF        804 +          RST  56
0EF2 2E        804 +          DEFB RESTOR
               804 +          IF   RESTOR.EQ.INTPC
               804 +          ENDIF
0EF3 AF        805            XOR  A
0EF4 12        806            LD   (DE),A
0EF5 C9        807            RET
               808  ; WRITE ROUTINE
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

0EF6 79         809  SCRWRT:  LD   A,C
0EF7 90         810           SUB  B
0EF8            811           SYSSUK INDEXB
0EF8 FF         811 +         RST  56
0EF9 5D         811 +         DEFB INDEXB+1
                811 +         IF   INDEXB.EQ.INTPC
                811 +         ENDIF
0EFA E44F       812           DEFW OSWO
0EFC E610       813           AND  10H
0EFE C8         814           RET  Z
0EFF 2B         815  SCRWR1:  DEC  HL            ; BACKUP TO POT
0F00 2B         816           DEC  HL
0F01 2B         817           DEC  HL
0F02 2B         818           DEC  HL
0F03 2B         819           DEC  HL
0F04 7E         820           LD   A,(HL)
0F05 07         821           RLCA
0F06 07         822           RLCA
0F07 4F         823           LD   C,A
0F08 E603       824           AND  3
0F0A            825           SYSSUK INDEXB      ; SET SIZES
0F0A FF         825 +         RST  56
0F0B 5D         825 +         DEFB INDEXB+1
                825 +         IF   INDEXB.EQ.INTPC
                825 +         ENDIF
0F0C 260F       826           DEFW SIZTBL
0F0E DD561B     827           LD   D,(IX+SCYC)
0F11 DD5E1A     828           LD   E,(IX+SCXC)
0F14 47         829           LD   B,A
0F15 79         830           LD   A,C
0F16 07         831           RLCA
0F17 07         832           RLCA
0F18 E603       833           AND  3
0F1A            834  SCRWR2:  SYSSUK INDEXB
0F1A FF         834 +         RST  56
0F1B 5D         834 +         DEFB INDEXB+1
                834 +         IF   INDEXB.EQ.INTPC
                834 +         ENDIF
0F1C 220F       835           DEFW COLMSK
0F1E 48         836           LD   C,B
0F1F            837           SYSTEM RECTAN
0F1F FF         837 +         RST  56
0F20 1C         837 +         DEFB RECTAN
                837 +         IF   RECTAN.EQ.INTPC
                837 +         ENDIF
0F21 C9         838           RET
0F22 00         839  COLMSK:  DEFB 0
0F23 55         840           DEFB 01010101B
0F24 AA         841           DEFB 10101010B
0F25 FF         842           DEFB 11111111B
0F26 01         843  SIZTBL:  DEFB 1
0F27 02         844           DEFB 2
0F28 04         845           DEFB 4
0F29 08         846  CDELTB:  DEFB 8
0F2A F8         847           DEFB -8
0F2B 01         848           DEFB 1
0F2C FF         849           DEFB -1
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND         COMMENT

               850   ; SAVE ROUTINE
0F2D 78        851   SCRSAV: LD   A,B
0F2E           852           SYSSUK INDEXB
0F2E FF        852 +         RST  56
0F2F 5D        852 +         DEFB INDEXB+1
               852 +         IF   INDEXB.EQ.INTPC
               852 +         ENDIF
0F30 E34F      853           DEFW OSWO-1
0F32 E610      854           AND  10H
0F34 C0        855           RET  NZ
0F35 E5        856           PUSH HL
0F36 DD561B    857           LD   D,(IX+SCYC)
0F39 DD5E1A    858           LD   E,(IX+SCXC)
0F3C           859           SYSTEM RELAB1
0F3C FF        859 +         RST  56
0F3D 3A        859 +         DEFB RELAB1
               859 +         IF   RELAB1.EQ.INTPC
               859 +         ENDIF
0F3E DD721D    860           LD   (IX+SCSADH),D
0F41 DD731C    861           LD   (IX+SCSADL),E
0F44 EB        862           EX   DE,HL
0F45 DDE5      863           PUSH IX
0F47 D1        864           POP  DE
0F48 010308    865           LD   BC,0803H       ; SAVE WORST CASE
0F4B           866           SYSTEM SAVE
0F4B FF        866 +         RST  56
0F4C 2C        866 +         DEFB SAVE
               866 +         IF   SAVE.EQ.INTPC
               866 +         ENDIF
0F4D E1        867           POP  HL
0F4E 18AF      868           JR   SCRWR1-$
               869   ; ZERO PLAYER GAME WRITE HANDLER
0F50 21F04E    870   ZEROPL: LD   HL,ZPSTMR      ; LOAD PTR TO SIZE TIMER
0F53 11F34E    871           LD   DE,ZPSIZ       ; AND SIZE TRACKER
0F56 35        872           DEC  (HL)           ; DECREMENT SIZE TIMER
0F57 F2690F    873           JP   P,ZPA          ; JUMP IF NO COUNTDOWN
0F5A           874           SYSSUK RANGED       ; GET NEW SIZE
0F5A FF        874 +         RST  56
0F5B 77        874 +         DEFB RANGED+1
               874 +         IF   RANGED.EQ.INTPC
               874 +         ENDIF
0F5C 30        875           DEFB 48
0F5D FE08      876           CP   8              ; 8-47?
0F5F 3802      877           JR   C,ZPO-$        ; NO - ZPO
0F61 E603      878           AND  3              ; YES - HAVE MORE 1-4S
0F63 3C        879   ZPO:    INC  A
0F64 12        880           LD   (DE),A         ; SET NEW SIZE
0F65           881           SYSSUK RANGED       ; GET NEW SIZE TIMER
0F65 FF        881 +         RST  56
0F66 77        881 +         DEFB RANGED+1
               881 +         IF   RANGED.EQ.INTPC
               881 +         ENDIF
0F67 78        882           DEFB 120
0F68 77        883           LD   (HL),A
0F69 23        884   ZPA:    INC  HL             ; ADVANCE TO COLOR STUFF
0F6A 13        885           INC  DE
0F6B 35        886           DEC  (HL)           ; AND DEC COLOR TIMER
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND          COMMENT

0F6C F2770F    887          JP   P,ZPB
0F6F           888          SYSSUK RANGED         ; GET NEW COLOR
0F6F FF        888 +        RST  56
0F70 77        888 +        DEFB RANGED+1
               888 +        IF   RANGED.EQ.INTPC
               888 +        ENDIF
0F71 04        889          DEFB 4
0F72 12        890          LD   (DE),A
0F73           891          SYSSUK RANGED         ; GET NEW COLOR TIMER
0F73 FF        891 +        RST  56
0F74 77        891 +        DEFB RANGED+1
               891 +        IF   RANGED.EQ.INTPC
               891 +        ENDIF
0F75 78        892          DEFB 120
0F76 77        893          LD   (HL),A
0F77 23        894  ZPB:    INC  HL               ; TO DIRECTION STUFF
0F78 13        895          INC  DE
0F79 35        896          DEC  (HL)             ; DECREMENT DIRECTION TIMER
0F7A F2930F    897          JP   P,ZPD
0F7D 11F54E    898  ZPC:    LD   DE,DIRVAL        ; DE = DIRECTION TRACKER
0F80           899          SYSSUK RANGED         ; DRAW NEW DIRECTION
0F80 FF        899 +        RST  56
0F81 77        899 +        DEFB RANGED+1
               899 +        IF   RANGED.EQ.INTPC
               899 +        ENDIF
0F82 0A        900          DEFB 10
0F83 3C        901          INC  A
0F84 FE03      902          CP   3                ; REJECT ILLEGAL VALUES
0F86 28F5      903          JR   Z,ZPC-$
0F88 FE07      904          CP   7
0F8A 28F1      905          JR   Z,ZPC-$
0F8C 12        906          LD   (DE),A
0F8D           907          SYSSUK RANGED
0F8D FF        907 +        RST  56
0F8E 77        907 +        DEFB RANGED+1
               907 +        IF   RANGED.EQ.INTPC
               907 +        ENDIF
0F8F 28        908          DEFB 40
0F90 32F24E    909          LD   (DIRTMR),A
0F93 1A        910  ZPD:    LD   A,(DE)           ; GET DIRECTION VALUE
0F94 CD0110    911          CALL GETDLT           ; GET DELTAS
0F97 010A4F    912          LD   BC,P1SCP+SCXC ; POINT AT COORDINATES
0F9A 0A        913          LD   A,(BC)
0F9B 82        914          ADD  A,D
0F9C FE50      915          CP   80
0F9E 30DD      916          JR   NC,ZPC-$         ; GET NEW DIRECTION IF AT LMT
0FA0 02        917          LD   (BC),A
0FA1 5F        918          LD   E,A              ; SAVE X COORDINATE
0FA2 03        919          INC  BC
0FA3 0A        920          LD   A,(BC)
0FA4 84        921          ADD  A,H
0FA5 FE2E      922          CP   46
0FA7 30D4      923          JR   NC,ZPC-$
0FA9 02        924          LD   (BC),A
0FAA 57        925          LD   D,A              ; SET Y COORDINATE
0FAB 21F34E    926          LD   HL,ZPSIZ         ; POINT AT SIZES AGAIN
0FAE 46        927          LD   B,(HL)
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

0FAF 23        928          INC  HL
0FB0 7E        929          LD   A,(HL)         ; GET COLOR TOO
0FB1 CD1A0F    930          CALL SCRWR2         ; DO FIRST WRITE
0FB4 67        931          LD   H,A            ; SAVE COLOR
0FB5 D5        932          PUSH DE             ; AND X,Y
0FB6 3E5C      933          LD   A,92           ; REFLECT Y
0FB8 90        934          SUB  B
0FB9 92        935          SUB  D
0FBA 57        936          LD   D,A
0FBB 7C        937          LD   A,H
0FBC           938          SYSTEM RECTAN
0FBC FF        938 +        RST  56
0FBD 1C        938 +        DEFB RECTAN
               938 +        IF   RECTAN.EQ.INTPC
               938 +        ENDIF
0FBE 3EA0      939          LD   A,160          ; REFLECT X
0FC0 91        940          SUB  C
0FC1 93        941          SUB  E
0FC2 5F        942          LD   E,A
0FC3 7C        943          LD   A,H
0FC4           944          SYSTEM RECTAN
0FC4 FF        944 +        RST  56
0FC5 1C        944 +        DEFB RECTAN
               944 +        IF   RECTAN.EQ.INTPC
               944 +        ENDIF
0FC6 E1        945          POP  HL             ; RESTORE X,Y
0FC7 54        946          LD   D,H            ; RESTORE Y
0FC8           947          SYSTEM RECTAN
0FC8 FF        947 +        RST  56
0FC9 1C        947 +        DEFB RECTAN
               947 +        IF   RECTAN.EQ.INTPC
               947 +        ENDIF
0FCA 3EFF      948          LD   A,0FFH         ; RESET TIMEOUT
0FCC 32EC4F    949          LD   (TIMOUT),A
0FCF 3E01      950  ZERO1:  LD   A,1            ; RESET COUNTER-TIMER
0FD1 182A      951          JR   ZERO2-$
0FD3 3AF34F    952  DOWRTS: LD   A,(NUMPLY)
0FD6 3D        953          DEC  A
0FD7 FE04      954          CP   4
0FD9 D2500F    955          JP   NC,ZEROPL
0FDC 21C40E    956          LD   HL,SCRUPD
0FDF CDAA0E    957          CALL ITER4
0FE2 21E50E    958          LD   HL,SCREST
0FE5 CDAA0E    959          CALL ITER4
0FE8 21F60E    960          LD   HL,SCRWRT
0FEB CDAA0E    961          CALL ITER4
               962  ; NOW GOING BACKWARDS SAVE AND WRITE EVERYBODY WITH TRIGG
0FEE 41        963          LD   B,C
0FEF 11E2FF    964  SCRB3:  LD   DE,-SCPSIZ
0FF2 DD19      965          ADD  IX,DE
0FF4 C5        966          PUSH BC
0FF5 CD2D0F    967          CALL SCRSAV
0FF8 C1        968          POP  BC
0FF9 10F4      969          DJNZ SCRB3-$
0FFB 3E04      970          LD   A,MOVTMR
0FFD 32D54F    971  ZERO2:  LD   (CTO),A
1000 C9        972          RET                 ; DONE
```

```
ADDR OBJECT   STMT  LABEL    OPCD OPERAND       COMMENT

               973  ; SUBROUTINE TO SCARE UP DELTAS
1001 C5        974  GETDLT: PUSH BC
1002 47        975          LD   B,A
1003           976          SYSSUK MSKTD
1003 FF        976 +        RST  56
1004 7F        976 +        DEFB MSKTD+1
               976 +        IF   MSKTD.EQ.INTPC
               976 +        ENDIF
1005 0001      977          DEFW 100H
1007 00        978          DEFB 0
1008 0001      979          DEFW 100H
100A C1        980          POP  BC
100B C9        981          RET
               982  ; INITIAL COLORS:
100C 08        983  INICOL: DEFB 08H
100D 5B        984          DEFB 5BH
100E A5        985          DEFB 0A5H
100F 07        986          DEFB 007H
1010 08        987          DEFB 08H
1011 5B        988          DEFB 5BH
1012 A5        989          DEFB 0A5H
1013 07        990          DEFB 07H
               991          ORG  4000H+3720
               992  ; SKETCH RAM:
4E88           993          DEFS 96
4EE8           994  SCRSTK:
4EE8           995  COLORS: DEFS 8
>4EF0          996  ZPSTMR  EQU  $
>4EF2          997  DIRTMR  EQU  ZPSTMR+2
>4EF3          998  ZPSIZ   EQU  DIRTMR+1
>4EF5          999  DIRVAL  EQU  ZPSIZ+2
4EF0          1000  P1SCP:  DEFS SCPSIZ
4F0E          1001  P2SCP:  DEFS SCPSIZ
4F2C          1002  P3SCP:  DEFS SCPSIZ
4F4A          1003  P4SCP:  DEFS SCPSIZ
4F68          1004          END

TOTAL ASSEMBLER ERRORS =
```

CROSS REFERENCE

LABEL	VALUE	REFERENCE	
A0	00E1	-508	
A1	0070	-520	
A2	0037	-532	
A3	001B	-544	
A4	000D	-556	
A5	0006	-562	
ACTINT	000E	-225	
ALKEYS	0214	-49	
AS0	00D4	-509	
AS1	006A	-521	
AS2	0034	-533	
AS3	001A	-545	
B0	00C8	-510	
B1	0064	-522	
B2	0031	-534	
B3	0018	-546	
BCDADD	0062	-277	
BCDCHS	006A	-281	
BCDDIV	0068	-280	
BCDMUL	0066	-279	
BCDNEG	006C	-282	
BCDSUB	0064	-278	
BEGIN	0E19	-662	
BEGRAM	4FCE	-594	
BITSPL	00A0	-43	
BLANK	002A	-243	
BMUSIC	0012	-229	
BYTEPL	0028	-42	671
C1	00BD	-511	
C2	005E	-523	
C3	002E	-535	
C4	0017	-547	
C5	000B	-557	
C6	0005	-563	
C7	0002	-566	
CBA	0009	-123	
CBB	0007	-121	
CBC	0006	-120	
CBD	0005	-119	
CBE	0004	-118	
CBFLAG	0008	-122	
CBH	000B	-125	
CBIXH	0003	-117	
CBIXL	0002	-116	
CBIYH	0001	-115	
CBIYL	0000	-114	
CBL	000A	-124	
CDELTB	0F29	-804	728
CHDOWN	0001	-111	
CHLEFT	0002	-110	
CHRDIS	0032	-248	
CHRIGH	0003	-109	
CHTRIG	0004	-108	

CHUP	0000	-112				
CNT	4FDD	-611				
COL0L	0004	-168				
COL0R	0000	-164				
COL1L	0005	-169				
COL1R	0001	-165				
COL2L	0006	-170				
COL2R	0002	-166				
COL3L	0007	-171				
COL3R	0003	-167				
COLBX	000B	-172				
COLLST	4FE8	-622				
COLMSK	0F22	-797	835			
COLORS	4EE8	-927	682	686	736	751
COLSET	0018	-234	686	751	751	
CONCM	0008	-189				
CS1	00B2	-512				
CS2	0059	-524				
CS3	002C	-536				
CS4	0015	-548				
CS5	000A	-558				
CT0	4FD5	-602	705	971		
CT1	4FD6	-603	753			
CT2	4FD7	-604				
CT3	4FD8	-605				
CT4	4FD9	-606				
CT5	4FDA	-607				
CT6	4FDB	-608				
CT7	4FDC	-609				
CTIMER	0203	-46				
D1	00A8	-513				
D2	0054	-525				
D3	0029	-537				
D4	0014	-549				
DABS	0072	-285				
DADD	006E	-283				
DECCTS	0010	-226				
DIRTMR	4EF2	-929	909	998		
DIRVAL	4EF5	-931	898			
DISNUM	0036	-250				
DISTIM	0052	-267				
DOIT	0044	-260	712	712		
DOITB	0046	-261				
DOWRTS	0FD3	-886	760			
DS1	009F	-514				
DS2	004F	-526				
DS3	0027	-538				
DS4	0013	-550				
DS5	0009	-559				
DS6	0004	-564				
DSMG	0070	-284				
DURAT	4FEA	-624				
E1	0096	-515				
E2	004A	-527				
E3	0025	-539				
E4	0012	-551				
EMUSIC	0014	-230				

END	00C0	-379							
ENDSCR	4FF4	-632							
F1	008D	-516							
F2	0046	-528							
F3	0022	-540							
F4	0011	-552							
F5	0008	-560							
FILL	001A	-235	670	674					
FIRSTC	2000	-40							
FNTSML	020D	-48							
FNTSYS	0206	-47							
FS1	0085	-517							
FS2	0042	-529							
FS3	0020	-541							
FS4	0010	-553							
FTBASE	0000	-93							
FTBYTE	0003	-96							
FTFSX	0001	-94							
FTFSY	0002	-95							
FTPTH	0006	-99							
FTPTL	0005	-98							
FTYSIZ	0004	-97							
G0	00FD	-506							
G1	007E	-518							
G2	003E	-530							
G3	001F	-542							
G4	000F	-554							
G5	0007	-561							
G6	0003	-565							
G7	0001	-567							
G8	0000	-568							
GAMSTB	4FF8	-634							
GETDLT	1001	-908	784	911					
GETNUM	004E	-265							
GETPAR	004C	-264	663	663					
GS0	00EE	-507							
GS1	0077	-519							
GS2	003B	-531							
GS3	001D	-543							
GS4	000E	-555							
GSBEND	0007	-62							
GSBSCR	0001	-61							
GSBTIM	0000	-60							
GTMINS	4FEE	-628							
GTSECS	4FED	-627							
HORAF	000F	-195							
HORCB	0009	-173							
HUMANR	0040	-257							
INCSCR	0054	-268							
INDEXB	005C	-274	728	728	736	736	782	782	812
		812	826	826	835	835	853	853	
INDEXN	0056	-271							
INDEXW	005A	-273							
INFBK	000D	-186							
INICOL	100C	-915	684						
INLIN	000F	-188							
INMOD	000E	-187							

INTPC	0000	-216	663	669	669	669	710	712	728
		736	751	782	805	812	826	835	838
		853	860	867	875	882	889	892	900
		908	939	945	948	977			
INTP@	0001	-666							
INTST	0008	-193							
ITER4	0EAA	-733	957	959	961				
ITER41	0EB3	-737	776						
ITRET	0EBA	-742	769						
KCTASC	0040	-258							
KEY0	0014	-206							
KEY1	0015	-207							
KEY2	0016	-208							
KEY3	0017	-209							
KEYB0	0E69	-701	762						
KEYB1	0E8C	-722	740						
KEYMES	0E65	-696	710						
KEYSEX	4FE3	-617	757						
KLRKSX	0E9C	-732	761						
KSCTRV	0014	-660	752						
MAGIC	000C	-190							
MAINLP	0E58	-693	707						
MATH	0056	-270							
MCALL	0006	-219							
MENU	004A	-263							
MENUST	0218	-50							
MJUMP	000A	-221							
MOVE	005E	-275	682						
MOVTMR	0004	-659	704	970					
MRET	0008	-220							
MRFLOP	0006	-101							
MRLOCK	4FF7	-633							
MROR	0004	-103							
MRROT	0002	-105							
MRSHFT	0003	-106							
MRXOR	0005	-102							
MRXPND	0003	-104							
MSKTD	007E	-291	977	977					
MUZAK	0012	-228							
MUZPC	4FCE	-596							
MUZSP	4FD0	-597							
MXSCR	021E	-51							
NEGT	0074	-286							
NOGAME	0235	-53							
NOPLAY	0228	-52	663						
NORMEM	4000	-39	670						
NUMPLY	4FF3	-631	665	764	952				
NWHDWR	0001	-36							
OA1	008F	-576							
OA2	0047	-577							
OA3	0023	-578							
OA4	0011	-579							
OA5	0008	-580							
OB0	00FE	-570							
OC0	00F1	-571							
OD1	00D6	-572							
OE1	00BF	-573							

OF1	00B4	-574							
OG1	00A0	-575							
OPOT0	4FDF	-613							
OPOT1	4FE0	-614							
OPOT2	4FE1	-615							
OPOT3	4FE2	-616							
OSW0	4FE4	-618	782	812	853				
OSW1	4FE5	-619							
OSW2	4FE6	-620							
OSW3	4FE7	-621							
P1SCP	4EF0	-932	674	690	763	912			
P2SCP	4F0E	-933	694						
P3SCP	4F2C	-934	698						
P4SCP	4F4A	-935	702						
PAWS	0050	-266							
PIZBRK	0048	-262							
POT0	001C	-201							
POT1	001D	-202							
POT2	001E	-203							
POT3	001F	-204							
PRIOR	4FF9	-635							
PSWCY	0000	-58							
PSWPV	0002	-57							
PSWSGN	0007	-55							
PSWZRO	0006	-56							
PVOLAB	4FD2	-598							
PVOLMC	4FD3	-599							
QUIT	0078	-288							
RANGED	0076	-287	875	875	882	882	889	889	892
		892	900	900	908	908			
RANSHT	4FEF	-630							
RCALL	0004	-218							
RECTAN	001C	-236	838	838	939	939	945	945	948
		948							
RELAB1	003A	-253	860	860					
RELABS	0038	-252							
RESTOR	002E	-245	805	805					
SAVE	002C	-244	867	867					
SCCLR	0E20	-664	723						
SCDOTB	0EA1	-735	712						
SCHEDR	000C	-224							
SCPSIZ	001E	-652	675	772	964	1000	1001	1002	1003
SCRB3	0FEF	-898	969						
SCREEN	0000	-41							
SCREST	0EE5	-765	958						
SCROLL	0030	-246							
SCRSAV	0F2D	-809	967						
SCRSTK	4EE8	-926	667						
SCRSTR	0016	-232							
SCRUP1	0EDA	-758	788						
SCRUPD	0EC4	-749	956						
SCRWR1	0EFF	-779	868						
SCRWR2	0F1A	-796	930						
SCRWRT	0EF6	-775	960						
SCSADH	001D	-657	802	860					
SCSADL	001C	-656	803	861					
SCSAVA	0000	-653							

SCT0	0001	-128	760						
SCT1	0002	-129	761						
SCT2	0003	-130							
SCT3	0004	-131							
SCT4	0005	-132							
SCT5	0006	-133							
SCT6	0007	-134							
SCT7	0008	-135							
SCXC	001A	-654	690	694	698	702	785	789	828
		858	912						
SCYC	001B	-655	790	794	827	857			
SEMI4S	4FDE	-612							
SENFLG	4FFA	-636							
SENTRY	0042	-259	710	710					
SETB	007A	-289	704						
SETOUT	0016	-233	678						
SETW	007C	-290	688	692	696	700			
SF0	0009	-136							
SF1	000A	-137							
SF2	000B	-138							
SF3	000C	-139							
SF4	000D	-140							
SF5	000E	-141							
SF6	000F	-142							
SF7	0010	-143							
SHIFTU	0060	-276							
SIZTBL	0F26	-801	826						
SJ0	0015	-152							
SJ1	0017	-154							
SJ2	0019	-156							
SJ3	001B	-158							
SKYD	0013	-145	762						
SKYU	0012	-146							
SNDBX	0018	-184							
SNUL	0000	-127							
SP0	001C	-147							
SP1	001D	-148							
SP2	001E	-149							
SP3	001F	-150							
SSEC	0011	-144							
ST0	0014	-151							
ST1	0016	-153							
ST2	0018	-155							
ST3	001A	-157							
STIMER	0200	-45							
STOREN	0058	-272							
STRDIS	0034	-249							
SUCK	000C	-222							
SW0	0010	-197							
SW1	0011	-198							
SW2	0012	-199							
SW3	0013	-200							
SYSRAM	4FCE	-639							
TIMOUT	4FEC	-626	949						
TMR60	4FEB	-625							
TONEA	0011	-177							
TONEB	0012	-178							

TONEC	0013	-179				
TONMO	0010	-176				
UMARGT	4FFB	-637				
UPISTR	0000	-215				
USERTB	4FFD	-638				
VBBLNK	0006	-87				
VBCCHK	0004	-84				
VBCH	0003	-83				
VBCL	0002	-82				
VBCLAT	0003	-91				
VBCLMT	0000	-89				
VBCREV	0001	-90				
VBDCH	0001	-81				
VBDCL	0000	-80				
VBDXH	0004	-68				
VBDXL	0003	-67				
VBDYH	0009	-73				
VBDYL	0008	-72				
VBLANK	0028	-242				
VBMR	0000	-64				
VBOAH	000E	-78				
VBOAL	000D	-77				
VBSACT	0007	-86				
VBSTAT	0001	-65				
VBTIMB	0002	-66				
VBXCHK	0007	-71				
VBXH	0006	-70				
VBXL	0005	-69				
VBYCHK	000C	-76				
VBYH	000B	-75				
VBYL	000A	-74				
VECT	003E	-255				
VECTC	003C	-254				
VERAF	000E	-194				
VERBL	000A	-174				
VIBRA	0014	-180				
VOICES	4FD4	-600				
VOLAB	0016	-181				
VOLC	0015	-182				
VOLN	0017	-183				
VWRITR	001E	-237				
WASTE	0FFF	-585				
WASTER	0FFF	-586				
WRIT	0024	-240				
WRITA	0026	-241				
WRITP	0022	-239				
WRITR	0020	-238				
XINTC	0002	-217	707			
XPAND	0019	-191				
XPNDON	0001	-35				
ZERO1	0FCF	-884				
ZERO2	0FFD	-905	951			
ZEROPL	0F50	-822	955			
ZPO	0F63	-829	877			
ZPA	0F69	-832	873			
ZPB	0F77	-838	887			
ZPC	0F7D	-842	903	905	916	923

ZPD	0F93	-850	897		
ZPSIZ	4EF3	-930	871	926	999
ZPSTMR	4EF0	-928	870	997	

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND       COMMENT

               641
               642          LIST S,X,M,T
               643          NLIST I
               644          ;*****************************
               645          ;* H V G   C H E C K M A T E *
               646          ;*****************************
               647          ;
               648          ;
               649          ; M A C R O S
               650          ;
               651  DEF4X:  MACR #A4X,#B4X,#C4X,#D4X
               652          DEFB #A4X
               653          DEFB #B4X
               654          DEFB #C4X
               655          DEFB #D4X
               656          ENDM
               657  WRECK   MACR
               658          DEFW 9.SHL.8+32
               659          DEFB 0000B
               660          ENDM
               661          ;
               662          ;
               663          ; E Q U A T E S
               664          ;
>0000          665  OLDWAY  EQU  1-NWHDWR      ;1=DO OLD WAY 0=DO NEW WAY
>0001          666  NEWWAY  EQU  1-OLDWAY      ;OPPOSITE OF OLDWAY
               667          ;VARIOUS EQU'S
>000C          668  RLMOVE  EQU  1100B         ;RIGHT AND LEFT MOVES
>0003          669  UDMOVE  EQU  0011B         ;UP AND DOWN MOVES
>0002          670  NGBIT   EQU  2             ;# OF GAMES BIT
>0003          671  NPBIT   EQU  3             ;# PLAYERS BIT
>0003          672  ANIMAX  EQU  3             ;MAX # TICKS PER ANIMATION FRAM
>009C          673  XMAX    EQU  (BYTEPL-1)*4  ;MAX X COORD
>0015          674  YLINES  EQU  21            ;# VERT BLOCKS
>000B          675  LOWY    EQU  11            ;LOWEST Y COORD
>005B          676  YMAX    EQU  ((YLINES-1)*4)+LOWY ;MAX Y COORD
>0000          677  LOWX    EQU  0             ;LOWEST X COORD
>0008          678  AMOVE   EQU  8H            ;AN ARBITRARY MOVE
>0009          679  MUSVOL  EQU  09H           ;MUSIC VOLUME
>0024          680  TDOPT   EQU  100100B       ;TIME DISPLAY OPTIONS
>0044          681  CDOPT   EQU  01000100B     ;COUNT DOWN OPT
>0010          682  WRITOR  EQU  010000B       ;WRIT WITH MAGIC OR
               683          ;PLAYER PACKET OFFSETS
>0000          684  LASTSW  EQU  0             ;LAST SWITCH SETTING
>0001          685  LASTMV  EQU  1             ;LAST ACTUAL MOVE
>0002          686  CURSW   EQU  2             ;CURRENT SWITCH SETTING
>0003          687  AROT    EQU  3             ;ARROW ROTATION AMOUNT
>0004          688  ARRX    EQU  4             ;ARROW X COORD
>0005          689  ARRY    EQU  5             ;ARROW Y COORD
>0006          690  PSTAT   EQU  6             ;PLAYER STATUS
               691          ;PLAYER STATUS MASKS
>0080          692  ACTIVE  EQU  80H
>0040          693  HUMAN   EQU  40H
>0007          694  ACTBIT  EQU  7             ;1=ACTIVE 0=DEAD
>0006          695  HUMBIT  EQU  6             ;1=HUMAN 0=COMPUTER
               696          ;SCREEN TABS
>0028          697  XTAB1   EQU  ((BYTEPL/4)*4)
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ADDR OBJECT    STMT   LABEL    OPCD OPERAND          COMMENT

>0050                 XTAB2    EQU  XTAB1*2
>0078                 XTAB3    EQU  XTAB1*3
>0014                 YTAB     EQU  (((YLINES-1)/4)*4)
>001F                 YTAB1    EQU  YTAB+LOWY
>0033                 YTAB2    EQU  (2*YTAB)+LOWY
>0047                 YTAB3    EQU  (3*YTAB)+LOWY
                               ;OFFSETS FOR EACH PLAYERS ROM DATA
>0000                 NOTE0    EQU  0                ;EACH DIRECTIONS NOTES
>0001                 NOTE1    EQU  1
>0002                 NOTE2    EQU  2
>0003                 NOTE3    EQU  3
>0004                 PPATL    EQU  4                ;PLAYER PAT ADDR LOW
>0005                 PPATH    EQU  5                ;PLAYER PAT ADDR HIGH
>0006                 PCDOP    EQU  6                ;PLAYER CHAR DISP OPT
>0007                 PSPOSX   EQU  7                ;X COORD OF PLAYER SCORE
>0008                 PSPOSY   EQU  8                ;Y COORD OF PLAYER SCORE
>0009                 PSDOP    EQU  9                ;PLAYER SCORE DISP OPT
                               ;MORE EQU'S
>00F6                 FORCEM   EQU  0F6H             ;VAL TO FORCE RANDOM MOVE
>0004                 WIDTH    EQU  4H               ;# PIXELS WIDE OF PLAYER PAT
>0004                 HEIGHT   EQU  4H               ;# PIXELS HIGH OF PLAYER PAT
>0D20                 ALLBYT   EQU  (YLINES*4)*BYTEPL ;ALL BYTES ON A SCREEN
>41B8                 STARTS   EQU  (LOWY*BYTEPL)+NORMEM ;LOWEST ADDR OF PLAY FI
>0001                 PATXSZ   EQU  1                ;#BYTES WIDE OF PLAYER PATTERN
>0004                 PATYSZ   EQU  4                ;#BYTES HIGH OF PLAYER PATTERN
>0104                 PATDIM   EQU  PATXSZ.SHL.8.OR.PATYSZ ;PATTERNS DIMENSIONS
>000F                 JUSJOY   EQU  0FH              ;ONLY JOY STICK BITS
>0008                 CBLEN    EQU  8                ;COLOR BLOCK LENGTH
>0008                 SBLEN    EQU  8                ;SOUND BLOCK LENGTH
>0000                 WPONOF   EQU  0
>0001                 WPOPT    EQU  1
>0002                 WPPAL    EQU  2
>0003                 WPPAH    EQU  3
>0005                 WPXSIZ   EQU  5
>0004                 WPYSIZ   EQU  4
                               ;
                               ;
                               ;
                               ORG  NORMEM+0F96H ;SHOULD BE EQUAL TO RSTART
                               ;UNCLEARED RAM
 4F96                 UNCRAM:
 4F96                 CURSCR:  DEFS 12               ;ALL CURRENT SCORES
                               ;CLEARED RAM
 4FA2                 CNOPL:   DEFS 1                ;CURRENT # PLAYERS
 4FA3                 PLIX:    DEFS 1                ;WHO IS CURRENT PLAYER
 4FA4                 CNOHUM:  DEFS 1                ;CURRENT # HUMANS
 4FA5                 TARRX:   DEFS 1                ;TEMP ARROW X COORD
 4FA6                 TARRY:   DEFS 1                ;TEMP ARROW Y COORD
 4FA7                 RMASK:   DEFS 1                ;ROTATE MASK
                      PPACKS:                        ;START OF PLAYER PACKETS
 4FA8                 PLAY0:   DEFS PSTAT+1
 4FAF                 PLAY1:   DEFS PSTAT+1
 4FB6                 PLAY2:   DEFS PSTAT+1
 4FBD                 PLAY3:   DEFS PSTAT+1
 4FC4                 ENDRAM:
>4FA1                 RSTART   EQU  BEGRAM-(ENDRAM-UNCRAM)+1 ; SHOULD BE RAM STA
                               ORG  1328H
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ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

1328          755   ONETIM:
              756           ;ONE TIME ONLY HOUSEKEEPING
1328 31964F   757           LD   SP,UNCRAM
132B          758           SYSSUK GETPAR
132B FF       758 +         RST  56
132C 4D       758 +         DEFB GETPAR+1
              758 +         IF   GETPAR.EQ.INTPC
              758 +         ENDIF
132D 3502     759           DEFW NOGAME
132F 82       760           DEFB 82H
1330 DC4F     761           DEFW CT7
1332          762           SYSSUK GETPAR
1332 FF       762 +         RST  56
1333 4D       762 +         DEFB GETPAR+1
              762 +         IF   GETPAR.EQ.INTPC
              762 +         ENDIF
1334 2802     763           DEFW NOPLAY
1336 01       764           DEFB 1
1337 F34F     765           DEFW NUMPLY
1339          766           SYSSUK FILL
1339 FF       766 +         RST  56
133A 1B       766 +         DEFB FILL+1
              766 +         IF   FILL.EQ.INTPC
              766 +         ENDIF
133B 964F     767           DEFW CURSCR
133D 0C00     768           DEFW 12
133F 00       769           DEFB 0
1340          770   FIREIT:
              771           ;RE-ENTRY POINT FROM END OF GAME
1340 F3       772           DI
1341 31964F   773           LD   SP,UNCRAM
1344          774           SYSTEM INTPC
1344 FF       774 +         RST  56
1345 00       774 +         DEFB INTPC
              774 +         IF   INTPC.EQ.INTPC
>0001         774 +INTP@    DEFL 1
              774 +         ENDIF
              775           ;OUTPUT COLOR BLOCK
1346          776           DO   COLSET
1346 19       776 +         DEFB COLSET+1
1347 AA17     777           DEFW CBLOCK
1349          778           DO   EMUSIC
1349 15       778 +         DEFB EMUSIC+1
              779           ;CLEAR JOY STICKS
134A          780           DO   FILL
134A 1B       780 +         DEFB FILL+1
134B E44F     781           DEFW OSWO
134D 0400     782           DEFW 4
134F 00       783           DEFB 0
              784           ;CLEAR ALL RAM DATA
1350          785           DO   FILL
1350 1B       785 +         DEFB FILL+1
1351 A24F     786           DEFW CNOPL
1353 2200     787           DEFW .RES.(PLAY3+PSTAT)-CNOPL+1
1355 00       788           DEFB 0
1356          789           DO   SETOUT
1356 17       789 +         DEFB SETOUT+1
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

1357 BE         790           DEFB .RES.((YLINES*4)+LOWY)*2 ;VER BLK
1358 40         791           DEFB 40H+0          ;HOR COL BND
1359 08         792           DEFB 08H            ;INTER MODE
                793           ;CLEAR SCORE BLOCKS
135A            794           DO   RECTAN
135A 1D         794 +         DEFB RECTAN+1
135B 0000       795           DEFW 0
135D A00B       796           DEFW 11.SHL.8+160
135F 55         797           DEFB 01010101B
1360            798           DO   RECTAN
1360 1D         798 +         DEFB RECTAN+1
1361 8000       799           DEFW 0.SHL.8+128
1363            800           WRECK
1363 2009       800 +         DEFW 9.SHL.8+32
1365 00         800 +         DEFB 0000B
1366            801           DO   RECTAN
1366 1D         801 +         DEFB RECTAN+1
1367 5800       802           DEFW 0.SHL.8+88
1369            803           WRECK
1369 2009       803 +         DEFW 9.SHL.8+32
136B 00         803 +         DEFB 0000B
136C            804           DO   RECTAN
136C 1D         804 +         DEFB RECTAN+1
136D 2800       805           DEFW 0.SHL.8+40
136F            806           WRECK
136F 2009       806 +         DEFW 9.SHL.8+32
1371 00         806 +         DEFB 0000B
1372            807           DO   RECTAN
1372 1D         807 +         DEFB RECTAN+1
1373 0000       808           DEFW 0.SHL.8+0
1375            809           WRECK
1375 2009       809 +         DEFW 9.SHL.8+32
1377 00         809 +         DEFB 0000B
1378            810           DO   ACTINT
1378 0F         810 +         DEFB ACTINT+1
1379            811           EXIT
1379 02         811 +         DEFB XINTC
>0000           811 +INTPC    DEFL 0
                812           ;INITIALIZE STARTING ADDRESS OF ARROWS
137A 212833     813           LD   HL,.RES.(YTAB2.SHL.8)+XTAB1
137D 22AC4F     814           LD   (PLAY0+ARRX),HL
1380 217833     815           LD   HL,.RES.(YTAB2.SHL.8)+XTAB3
1383 22B34F     816           LD   (PLAY1+ARRX),HL
1386 21501F     817           LD   HL,.RES.(YTAB1.SHL.8)+XTAB2
1389 22BA4F     818           LD   (PLAY2+ARRX),HL
138C 215047     819           LD   HL,.RES.(YTAB3.SHL.8)+XTAB2
138F 22C14F     820           LD   (PLAY3+ARRX),HL
                821           ;CLEAR FIELD
1392 CDB414     822           CALL CLEARF
                823           ;DISPLAY # GAMES
1395 DD210D02   824           LD   IX,FNTSML
1399            825           SYSSUK DISNUM
1399 FF         825 +         RST  56
139A 37         825 +         DEFB DISNUM+1
                825 +         IF   DISNUM.EQ.INTPC
                825 +         ENDIF
139B 4C         826           DEFB 76
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND      COMMENT

139C 02         827           DEFB 2
139D 24         828           DEFB TDOPT
139E 42         829           DEFB 42H
139F DC4F       830           DEFW CT7
13A1            831  DONTD:
                832           ;GET # HUMANS
13A1 3AF34F     833           LD   A,(NUMPLY)
13A4 FE05       834           CP   5
13A6 3802       835           JR   C,GOTNPL-$
13A8 3E04       836           LD   A,4
13AA            837  GOTNPL:
13AA 32A44F     838           LD   (CNOHUM),A
                839           ;GET # PLAYERS:
                840           ; IF HUMANS=1 OR 0 OR > 4 THEN PLAYERS=4 ELSE PLA
13AD FE02       841           CP   2
13AF 3804       842           JR   C,FPLAY-$
13B1 FE05       843           CP   5
13B3 3802       844           JR   C,ALLHUM-$
13B5 3E04       845  FPLAY:   LD   A,4
13B7 32A24F     846  ALLHUM:  LD   (CNOPL),A
                847           ;INITIALIZE THE PLAYER PACKETS
                848           ;B=CURR # HUMANS
                849           ;C=CURR # PLAYERS
                850           ;D=THIS PLAYER #
13BA 3AA44F     851  INTIPP:  LD   A,(CNOHUM)
13BD 47         852           LD   B,A
13BE 3AA24F     853           LD   A,(CNOPL)
13C1 4F         854           LD   C,A
13C2 1600       855           LD   D,0
13C4 7A         856  GTPLIX:  LD   A,D
13C5 CD5C16     857           CALL LDPLIX
13C8 C5         858           PUSH BC
13C9 D5         859           PUSH DE
13CA 7A         860           LD   A,D
13CB C631       861           ADD  A,31H         ;SET UP ASCII LITERAL
13CD DD5E04     862           LD   E,(IX+ARRX)
13D0 DD5605     863           LD   D,(IX+ARRY)
13D3 1D         864           DEC  E
13D4 1D         865           DEC  E
13D5 FD4E06     866           LD   C,(IY+PCDOP)
13D8            867           SYSTEM CHRDIS      ;DISPLAY PLAYER# ON FIELD
13D8 FF         867 +         RST  56
13D9 32         867 +         DEFB CHRDIS
                867 +         IF   CHRDIS.EQ.INTPC
                867 +         ENDIF
13DA FD5E07     868           LD   E,(IY+PSPOSX)
13DD FD5608     869           LD   D,(IY+PSPOSY)
13E0 D5         870           PUSH DE
13E1            871           SYSTEM CHRDIS      ;DISPLAY# ON SCORE BLOCK
13E1 FF         871 +         RST  56
13E2 32         871 +         DEFB CHRDIS
                871 +         IF   CHRDIS.EQ.INTPC
                871 +         ENDIF
13E3 D1         872           POP  DE
13E4 7B         873           LD   A,E
13E5 C606       874           ADD  A,6
13E7 5F         875           LD   E,A
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

13E8 14         876           INC  D
13E9 14         877           INC  D
13EA 010104     878           LD   BC,PATYSZ.SHL.8+PATXSZ
13ED FD6605     879           LD   H,(IY+PPATH)
13F0 FD6E04     880           LD   L,(IY+PPATL)
13F3 3E10       881           LD   A,00010000B
13F5            882           SYSTEM WRIT         ;WRIT PLAYER PAT IN SCORE BLOCK
13F5 FF         882 +         RST  56
13F6 24         882 +         DEFB WRIT
                882 +         IF   WRIT.EQ.INTPC
                882 +         ENDIF
13F7 D1         883           POP  DE
13F8 D5         884           PUSH DE
13F9 DDE5       885           PUSH IX
13FB 7A         886           LD   A,D
13FC 0600       887           LD   B,0
13FE 4A         888           LD   C,D
13FF 21964F     889           LD   HL,CURSCR
1402 09         890           ADD  HL,BC
1403 09         891           ADD  HL,BC
1404 09         892           ADD  HL,BC
1405 CDE315     893           CALL DISPSC         ;DISPLAY SCORES
1408 DDE1       894           POP  IX
140A D1         895           POP  DE
140B C1         896           POP  BC
140C AF         897           XOR  A
140D B0         898           OR   B
140E 2809       899           JR   Z,NOTHUM-$
1410 3EC0       900           LD   A,ACTIVE+HUMAN
1412 DD7706     901           LD   (IX+PSTAT),A
1415 05         902           DEC  B
1416 1806       903           JR   CKNOPL-$
1418 00         904  CKSUM3:  DEFB 0              ;
1419 3E80       905  NOTHUM:  LD   A,ACTIVE
141B DD7706     906           LD   (IX+PSTAT),A
141E 14         907  CKNOPL:  INC  D
141F 0D         908           DEC  C
1420 AF         909           XOR  A
1421 B1         910           OR   C
1422 20A0       911           JR   NZ,GTPLIX-$
1424 3E03       912           LD   A,3
1426            913  CDOWNL:
1426 F5         914           PUSH AF
1427            915           SYSSUK PAWS
1427 FF         915 +         RST  56
1428 51         915 +         DEFB PAWS+1
                915 +         IF   PAWS.EQ.INTPC
                915 +         ENDIF
1429 05         916           DEFB 5
142A 32A34F     917           LD   (PLIX),A
142D CD9114     918           CALL UPMUZK         ;MAKE SOUND FOR COUNT DOWN
1430 F1         919           POP  AF
1431 F5         920           PUSH AF
1432 C630       921           ADD  A,30H
1434            922           XYRELL DE,(XTAB2-4),.RES.(YTAB2-4)
1434 00000000   922 +         LD   DE,.RES.(.RES.(YTAB2-4)).SHL.8+((XTAB2-4))
1438 0E44       923           LD   C,CDOPT
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ADDR OBJECT   STMT  LABEL   OPCD OPERAND      COMMENT

143A           924          SYSTEM CHRDIS     ;DISPLAY COUNT DOWN #
143A FF        924 +        RST   56
143B 32        924 +        DEFB CHRDIS
               924 +        IF    CHRDIS.EQ.INTPC
               924 +        ENDIF
143C           925          SYSSUK PAWS
143C FF        925 +        RST   56
143D 51        925 +        DEFB PAWS+1
               925 +        IF    PAWS.EQ.INTPC
               925 +        ENDIF
143E 28        926          DEFB 40
143F           927          SYSTEM EMUSIC
143F FF        927 +        RST   56
1440 14        927 +        DEFB EMUSIC
               927 +        IF    EMUSIC.EQ.INTPC
               927 +        ENDIF
1441 F1        928          POP   AF
1442 3D        929          DEC   A
1443 20E1      930          JR    NZ,CDOWNL-$
1445 CDB414    931          CALL CLEARF
               932          ;INIT TICK COUNT
1448 CD4A16    933          CALL TICKIT
144B AF        934          XOR   A
144C 32DD4F    935          LD    (CNT),A
144F           936   LOOPY:
144F           937          SYSSUK SENTRY
144F FF        937 +        RST   56
1450 43        937 +        DEFB SENTRY+1
               937 +        IF    SENTRY.EQ.INTPC
               937 +        ENDIF
1451 1402      938          DEFW ALKEYS
1453           939          SYSSUK DOIT
1453 FF        939 +        RST   56
1454 45        939 +        DEFB DOIT+1
               939 +        IF    DOIT.EQ.INTPC
               939 +        ENDIF
1455 5914      940          DEFW THETBL
1457 18F6      941          JR    LOOPY-$
1459           942   THETBL: RC   SCT0,ACTION
1459 41        942 +        DEFB SCT0+40H
145A 6C14      942 +        DEFW ACTION
               942 +        IF    0
               942 +        ENDIF
145C           943          RC    SJ0,MOVJOY
145C 55        943 +        DEFB SJ0+40H
145D 8414      943 +        DEFW MOVJOY
               943 +        IF    0
               943 +        ENDIF
145F           944          RC    SJ1,MOVJOY
145F 57        944 +        DEFB SJ1+40H
1460 8414      944 +        DEFW MOVJOY
               944 +        IF    0
               944 +        ENDIF
1462           945          RC    SJ2,MOVJOY
1462 59        945 +        DEFB SJ2+40H
1463 8414      945 +        DEFW MOVJOY
               945 +        IF    0
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

               945 +          ENDIF
1465           946            RC   SJ3,MOVJOY
1465 5B        946 +          DEFB SJ3+40H
1466 8414      946 +          DEFW MOVJOY
               946 +          IF   0
               946 +          ENDIF
1468           947            RC   SKYD,CALPIZ,+END
1468 53        947 +          DEFB SKYD+40H
1469 8B14      947 +          DEFW CALPIZ
               947 +          IF   0+END
146B C0        947 +          DEFB 0+END
               947 +          ENDIF
146C           948   ACTION:
146C CD4A16    949            CALL TICKIT
               950            ;INCREMENT THE CURRENT PLAYER INDEX BY 1 UNTIL
               951            ;AN ACTIVE PLAYER IS FOUND THEN UPDATE HIM
146F 3AA34F    952   INCIX:   LD   A,(PLIX)
1472 3C        953            INC  A
1473 E603      954            AND  03H
1475 32A34F    955            LD   (PLIX),A      ;CURR PLAYER IX<-CURR PL IX+1 M
1478 CD5C16    956            CALL LDPLIX
147B DDCB067E  957            BIT  ACTBIT,(IX+PSTAT) ;TEST FOR ACTIVE PLAYER
147F 28EE      958            JR   Z,INCIX-$
1481 C3BC14    959            JP   MOVEIT        ;THE MAJOR EVENT
1484           960   MOVJOY:
1484 D615      961            SUB  SJ0           ;TAKE OFF WHATEVER
1486 CB3F      962            SRL  A             ;DIV BY 2
1488 C31E16    963            JP   STALL
148B           964   CALPIZ:
148B CD4A16    965            CALL TICKIT
148E           966            SYSTEM PIZBRK
148E FF        966 +          RST  56
148F 48        966 +          DEFB PIZBRK
               966 +          IF   PIZBRK.EQ.INTPC
               966 +          ENDIF
1490 C9        967            RET
1491 3AA34F    968   UPMUZK:  LD   A,(PLIX)
1494 CD5C16    969            CALL LDPLIY
1497 DD7E03    970            LD   A,(IX+AROT)
149A 0603      971            LD   B,3
149C           972   TSTBIT:
149C 0F        973            RRCA
149D 3802      974            JR   C,GOTBIT-$
149F 10FB      975            DJNZ TSTBIT-$
14A1           976   GOTBIT:
14A1 48        977            LD   C,B
14A2 0600      978            LD   B,0
14A4 FD09      979            ADD  IY,BC
14A6 FD7E00    980            LD   A,(IY+0)
14A9 D313      981            OUT  (TONEC),A
14AB 3E09      982            LD   A,MUSVOL
14AD D315      983            OUT  (VOLC),A
14AF 3E11      984            LD   A,0A4
14B1 D310      985            OUT  (TONMO),A
14B3 C9        986            RET
14B4           987   CLEARF:
               988            ;CLEAR FIELD
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ADDR OBJECT    STMT  LABEL   OPCD OPERAND       COMMENT

14B4            989          SYSSUK FILL
14B4 FF         989 +        RST  56
14B5 1B         989 +        DEFB FILL+1
                989 +        IF   FILL.EQ.INTPC
                989 +        ENDIF
14B6 B841       990          DEFW STARTS
14B8 200D       991          DEFW ALLBYT
14BA 00         992          DEFB 0
14BB C9         993          RET
14BC            994  MOVEIT:
                995          ;THIS ROUTINE UPDATES A PLAYER'S POSITION
                996          ;INPUT PARAS ARE: IX=POINTER TO PLAYERS PACKET
                997          ;DURING ROUTINE B=CURRENT SWITCH C=LAST SWITCH
14BC DD4E00     998          LD   C,(IX+LASTSW)
14BF DD4602     999          LD   B,(IX+CURSW)
14C2 DDCB0676  1000          BIT  HUMBIT,(IX+PSTAT)
14C6 2003      1001          JR   NZ,NOCUR-$     ;IF NOT HUMAN
14C8 AF        1002  ZSW:    XOR  A              ; CLEAR A
14C9 47        1003          LD   B,A            ;CLEAR CURRENT SWITCH
14CA 4F        1004          LD   C,A            ;CLEAR LAST SW ENDIF
14CB 78        1005  NOCUR:  LD   A,B            ;IF CURR SW = 0
14CC B7        1006          OR   A
14CD 2001      1007          JR   NZ,RANTST-$
14CF 41        1008          LD   B,C            ;THEN CURR SW<-LAST SW ENDIF
14D0 DD7000    1009  RANTST: LD   (IX+LASTSW),B ;SAVE LAST SW
14D3 78        1010          LD   A,B            ;IF CURR SW=0
14D4 B7        1011          OR   A
14D5 2005      1012          JR   NZ,GOTSW-$
14D7 0E00      1013          LD   C,0            ;LAST SW<-0
14D9 CD7F16    1014          CALL RANMOV         ;GET RANDOM MOVE ENDIF
14DC           1015  GOTSW:
14DC DD7E01    1016          LD   A,(IX+LASTMV) ;GET LAST MOVE
14DF CDAC16    1017          CALL MOVTST
14E2 2813      1018          JR   Z,GOTMOV-$
               1019                             ;ANY MOVE AND CURR SW
14E4 CDAA16    1020          CALL MOVANY
14E7 280E      1021          JR   Z,GOTMOV-$
14E9 41        1022          LD   B,C            ;TRY LAST SWITCH
               1023                             ;ANY MOVE
14EA CDAA16    1024          CALL MOVANY
14ED 2808      1025          JR   Z,GOTMOV-$
14EF DD4601    1026          LD   B,(IX+LASTMV) ;TRY LAST MOVE
               1027                             ;ANY MOVE
14F2 CDAA16    1028          CALL MOVANY
14F5 203C      1029          JR   NZ,CRASH-$     ;
14F7           1030  GOTMOV:
               1031          ;A LEGIT MOVE HAS BEEN FOUND SO UPDATE THE GUY
14F7 DD7701    1032          LD   (IX+LASTMV),A ;SAVE ACTUAL MOVE FOR LATER
14FA DD7703    1033          LD   (IX+AROT),A   ;ARROW ROTATION AMOUNT<-THE MOV
14FD DD5605    1034          LD   D,(IX+ARRY)
1500 DD5E04    1035          LD   E,(IX+ARRX)
1503 CD2515    1036          CALL ERASE
1506 FD6605    1037          LD   H,(IY+PPATH)
1509 FD6E04    1038          LD   L,(IY+PPATL)
150C 010104    1039          LD   BC,PATYSZ.SHL.8+PATXSZ
150F 3E10      1040          LD   A,WRITOR
1511           1041          SYSTEM WRIT         ;WRITE PLAYER PATTERN OVER ARRO
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

1511 FF        1041 +         RST  56
1512 24        1041 +         DEFB WRIT
               1041 +         IF   WRIT.EQ.INTPC
               1041 +         ENDIF
1513 3AA54F    1042           LD   A,(TARRX)
1516 DD7704    1043           LD   (IX+ARRX),A  ;SAVE NEW ARROW X
1519 3AA64F    1044           LD   A,(TARRY)
151C DD7705    1045           LD   (IX+ARRY),A  ;SAVE NEW ARROW Y
151F CD0016    1046           CALL ANIARR       ;ANIMATE THE ARROW
1522 C39114    1047           JP   UPMUZK
1525           1048  ERASE:
1525 D5        1049           PUSH DE
1526           1050           SYSSUK RELAB1
1526 FF        1050 +         RST  56
1527 3B        1050 +         DEFB RELAB1+1
               1050 +         IF   RELAB1.EQ.INTPC
               1050 +         ENDIF
1528 00        1051           DEFB 0
1529 EB        1052           EX   DE,HL
152A 0600      1053           LD   B,0
152C 110104    1054           LD   DE,PATYSZ.SHL.8+PATXSZ
152F           1055           SYSTEM BLANK
152F FF        1055 +         RST  56
1530 2A        1055 +         DEFB BLANK
               1055 +         IF   BLANK.EQ.INTPC
               1055 +         ENDIF
1531 D1        1056           POP  DE
1532 C9        1057           RET
1533           1058  CRASH:
               1059           ;A PLAYER HAS CRASHED.  DESTROY HIS ARROW AND ELIM
               1060           ;HIM FROM THE GAME.
1533 016D17    1061           LD   BC,EXPATS
1536 118117    1062           LD   DE,EXCOLS     ;DE<-EXPLODE COLOR TABLE ADDR
1539 3E05      1063           LD   A,5
153B 21B217    1064           LD   HL,EXPSND
153E F5        1065  EXLOOP:  PUSH AF           ;PUSH LOOP COUNT
153F C5        1066           PUSH BC           ;PUSH EXT PAT ADDR
1540 D5        1067           PUSH DE           ;PUSH EXPLODE COLOR TBL ADDR
1541 E5        1068           PUSH HL           ;PUSH EXPLODE SOUND ADDR
1542 1A        1069           LD   A,(DE)       ;A<-EXPLODE COLOR
1543 D300      1070           OUT  (COLOR),A
1545 C5        1071           PUSH BC
1546 DD5605    1072           LD   D,(IX+ARRY)
1549 DD5E04    1073           LD   E,(IX+ARRX)
154C CD2515    1074           CALL ERASE
154F E1        1075           POP  HL           ;PAT ADDR
1550 3E10      1076           LD   A,WRITOR
1552 010104    1077           LD   BC,PATYSZ.SHL.8+PATXSZ
1555           1078           SYSTEM WRIT       ;WRIT EXPLOSION
1555 FF        1078 +         RST  56
1556 24        1078 +         DEFB WRIT
               1078 +         IF   WRIT.EQ.INTPC
               1078 +         ENDIF
1557           1079           SYSSUK PAWS
1557 FF        1079 +         RST  56
1558 51        1079 +         DEFB PAWS+1
               1079 +         IF   PAWS.EQ.INTPC
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND          COMMENT

               1079 +         ENDIF
1559 07        1080           DEFB 7
155A E1        1081           POP  HL               ;GET EXPLODE SOUND ADDR
155B 011808    1082           LD   BC,SBLEN.SHL.8+SNDBX
155E EDB3      1083           OTIR
1560 D1        1084           POP  DE
1561 C1        1085           POP  BC
1562 F1        1086           POP  AF
1563 3D        1087           DEC  A
1564 2807      1088           JR   Z,EXPFIN-$       ; LOOP COUNT EXPIRED
1566 13        1089           INC  DE               ;INC TO NEXT COLOR
1567 03        1090           INC  BC               ;BUMP UP TO NEXT PAT ADDR
1568 03        1091           INC  BC
1569 03        1092           INC  BC
156A 03        1093           INC  BC
156B 18D1      1094           JR   EXLOOP-$
156D           1095  EXPFIN:
156D FD5605    1096           LD   D,(IY+PPATH)
1570 FD5E04    1097           LD   E,(IY+PPATL) ;DE<-PLAYER PAT ADDR
1573 FD210000  1098           LD   IY,0
1577 FD19      1099           ADD  IY,DE            ;IY<-PLAYER PAT ADDR
1579 110004    1100           LD   DE,4.SHL.8+0 ;D<-LOOP COUNT
157C FD7E00    1101  STOMP:   LD   A,(IY+0)         ;A<-BYTE OF PLAYER PATTERN
157F 21B841    1102           LD   HL,STARTS
1582 01200D    1103           LD   BC,ALLBYT
1585 EDB1      1104  STLOOP:  CPIR
1587 2005      1105           JR   NZ,RESTOM-$
1589 03        1106           INC  BC
158A 2B        1107           DEC  HL
158B 73        1108           LD   (HL),E
158C 18F7      1109           JR   STLOOP-$
158E FD23      1110  RESTOM:  INC  IY
1590 15        1111           DEC  D
1591 20E9      1112           JR   NZ,STOMP-$
1593 DDCB0676  1113           BIT  HUMBIT,(IX+PSTAT) ;
1597 2804      1114           JR   Z,KILLST-$      ;IF HUMAN
1599 21A44F    1115           LD   HL,CNOHUM
159C 35        1116           DEC  (HL)             ;DEC CURRENT # HUMANS ENDIF
159D DDCB06BE  1117  KILLST:  RES  ACTBIT,(IX+PSTAT) ;KILL STATUS
               1118           ;INC ALL ACTIVE PLAYERS SCORES
15A1 0E04      1119           LD   C,4
15A3           1120  BUMPEM:
15A3 0D        1121           DEC  C
15A4 79        1122           LD   A,C
15A5 CD5C16    1123           CALL LDPLIX
15A8 DDCB067E  1124           BIT  ACTBIT,(IX+PSTAT)
15AC 2818      1125           JR   Z,BUMPCK-$
15AE 0600      1126           LD   B,0
15B0 C5        1127           PUSH BC
15B1 79        1128           LD   A,C
15B2 21964F    1129           LD   HL,CURSCR
15B5 09        1130           ADD  HL,BC
15B6 09        1131           ADD  HL,BC
15B7 09        1132           ADD  HL,BC
15B8 37        1133           SCF
15B9 CDE315    1134           CALL DISPSC
15BC C1        1135           POP  BC
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ADDR OBJECT    STMT   LABEL    OPCD OPERAND       COMMENT

15BD           1136            SYSTEM INCSCR
15BD FF        1136 +          RST  56
15BE 54        1136 +          DEFB INCSCR
               1136 +          IF   INCSCR.EQ.INTPC
               1136 +          ENDIF
15BF 79        1137            LD   A,C
15C0 C5        1138            PUSH BC
15C1 B7        1139            OR   A             ;RESET CARRY
15C2 CDE315    1140            CALL DISPSC
15C5 C1        1141            POP  BC
15C6           1142   BUMPCK:
15C6           1143            SYSSUK PAWS
15C6 FF        1143 +          RST  56
15C7 51        1143 +          DEFB PAWS+1
               1143 +          IF   PAWS.EQ.INTPC
               1143 +          ENDIF
15C8 1E        1144            DEFB 30
15C9 79        1145            LD   A,C
15CA B7        1146            OR   A
15CB 20D6      1147            JR   NZ,BUMPEM-$
               1148            ;DEC CURR # PLAYERS
               1149            ;IF CURR # PLAYERS LEQ 1 GO TO END GAME
15CD 21A24F    1150            LD   HL,CNOPL
15D0 35        1151            DEC  (HL)
15D1 35        1152            DEC  (HL)
15D2 2802      1153            JR   Z,ENDCHK-$
15D4 34        1154            INC  (HL)
15D5 C9        1155            RET
15D6           1156   ENDCHK:
15D6 3ADC4F    1157            LD   A,(CT7)
15D9 3D        1158            DEC  A
15DA 27        1159            DAA
15DB 32DC4F    1160            LD   (CT7),A
15DE C24013    1161            JP   NZ,FIREIT
15E1           1162            SYSTEM QUIT
15E1 FF        1162 +          RST  56
15E2 78        1162 +          DEFB QUIT
               1162 +          IF   QUIT.EQ.INTPC
               1162 +          ENDIF
15E3           1163   DISPSC:
               1164            ;DISPLAY SCORE
               1165            ;A=PLAYER#
               1166            ;HL->LAST BYTE OF SCORE
15E3 FD4E09    1167            LD   C,(IY+PSDOP)
15E6 3004      1168            JR   NC,NOTXOR-$
15E8 CBA1      1169            RES  MROR,C
15EA CBE9      1170            SET  MRXOR,C
15EC           1171   NOTXOR:
15EC FD5E07    1172            LD   E,(IY+PSPOSX)
15EF FD5608    1173            LD   D,(IY+PSPOSY)
15F2 3E0C      1174            LD   A,12
15F4 83        1175            ADD  A,E
15F5 5F        1176            LD   E,A
15F6 14        1177            INC  D
15F7 0643      1178            LD   B,43H
15F9 DD210D02  1179            LD   IX,FNTSML
15FD           1180            SYSTEM DISNUM
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

15FD FF        1180 +         RST   56
15FE 36        1180 +         DEFB DISNUM
               1180 +         IF    DISNUM.EQ.INTPC
               1180 +         ENDIF
15FF C9        1181           RET
1600           1182  ANIARR:
               1183           ;ANIMATE THE ARROW
               1184           ;INPUT AND OUTPUT IS IX WHO STAYS THE SAME
               1185           ;DESTROYS ALL OTHER REGISTERS
1600 DDCB067E  1186           BIT   ACTBIT,(IX+PSTAT)
1604 C8        1187           RET   Z              ;EXIT IF NOT ACTIVE
1605 DD7E03    1188           LD    A,(IX+AROT)
1608 CD2F17    1189           CALL GETROT          ;HL<-ARROW PAT ADDR
160B DD5605    1190           LD    D,(IX+ARRY)
160E DD5E04    1191           LD    E,(IX+ARRX)
1611 E5        1192           PUSH HL
1612 CD2515    1193           CALL ERASE
1615 E1        1194           POP   HL
1616 010104    1195           LD    BC,PATYSZ.SHL.8+PATXSZ
1619 3E10      1196           LD    A,WRITOR
161B           1197           SYSTEM WRIT
161B FF        1197 +         RST   56
161C 24        1197 +         DEFB WRIT
               1197 +         IF    WRIT.EQ.INTPC
               1197 +         ENDIF
161D C9        1198           RET
161E           1199  STALL:
               1200           ;THIS ROUTINE TAKES CARE OF ARROW ANIMATION
               1201           ;AND SHOWING A PLAYER HIS CURRENT JOY STICK POSIT
               1202           ;A=WHICH PLAYER:
               1203           ;B=JOY STICK BITS
161E CD5C16    1204           CALL LDPLIX          ;IX<-ADDR OF PLAYER PACKET
1621 AF        1205           XOR   A
1622 B0        1206           OR    B
1623 2003      1207           JR    NZ,STORIT-$
1625 DD7E02    1208           LD    A,(IX+CURSW)
1628 DD7702    1209  STORIT:  LD    (IX+CURSW),A
162B DDAE01    1210           XOR   (IX+LASTMV)    ;A<-DIFFERENCE FROM LAST MOVE
162E 2812      1211           JR    Z,GETLM-$      ;IF DIFFERENCE=0 USE LAST MOVE
1630 EE0C      1212           XOR   RLMOVE
1632 280E      1213           JR    Z,GETLM-$
1634 EE0C      1214           XOR   RLMOVE
1636 EE03      1215           XOR   UDMOVE
1638 2808      1216           JR    Z,GETLM-$
163A EE03      1217           XOR   UDMOVE
163C DDCB0676  1218  HUMCHK:  BIT   HUMBIT,(IX+PSTAT)
1640 2003      1219           JR    NZ,GOTIT-$     ;IF HUMAN WE'VE GOT IT
1642 DD7E01    1220  GETLM:   LD    A,(IX+LASTMV) ;GET LAST MOVE
1645 DD7703    1221  GOTIT:   LD    (IX+AROT),A   ;STORE ARROW ROTATION
1648 18B6      1222           JR    ANIARR-$
164A           1223  TICKIT:
               1224           ;TICK COUNT<-(8-CURR # PLAYERS)
164A 3AA44F    1225           LD    A,(CNOHUM)
164D B7        1226           OR    A
164E 3E02      1227           LD    A,2
1650 2806      1228           JR    Z,STICK-$
1652 21A24F    1229           LD    HL,CNOPL
```

```
ADDR OBJECT   STMT  LABEL    OPCD OPERAND      COMMENT

1655 3E08     1230           LD   A,8
1657 96       1231           SUB  (HL)
1658 32D54F   1232  STICK:   LD   (CTO),A
165B C9       1233           RET
165C          1234  LDPLIX:
165C          1235  LDPLIY:
              1236           ;LOAD IY WITH POINTER TO CURR PLAYER ROM DATA
              1237           ;LOAD IX WITH A POINTER TO CURRENT PLAYER PACKET
              1238           ;A=PLAYER# MUST BE GEQ 0 & LEQ 3
165C D5       1239           PUSH DE
165D E5       1240           PUSH HL
165E          1241           SYSSUK INDEXW
165E FF       1241 +         RST  56
165F 5B       1241 +         DEFB INDEXW+1
              1241 +         IF   INDEXW.EQ.INTPC
              1241 +         ENDIF
1660 6F16     1242           DEFW ROMTBL
1662 D5       1243           PUSH DE
1663 FDE1     1244           POP  IY
1665          1245           SYSSUK INDEXW
1665 FF       1245 +         RST  56
1666 5B       1245 +         DEFB INDEXW+1
              1245 +         IF   INDEXW.EQ.INTPC
              1245 +         ENDIF
1667 7716     1246           DEFW RAMTBL
1669 D5       1247           PUSH DE
166A DDE1     1248           POP  IX
166C E1       1249           POP  HL
166D D1       1250           POP  DE
166E C9       1251           RET
166F 4517     1252  ROMTBL:  DEFW PLROM0
1671 4F17     1253           DEFW PLROM1
1673 5917     1254           DEFW PLROM2
1675 6317     1255           DEFW PLROM3
1677 A84F     1256  RAMTBL:  DEFW PLAY0
1679 AF4F     1257           DEFW PLAY1
167B B64F     1258           DEFW PLAY2
167D BD4F     1259           DEFW PLAY3
167F          1260  RANMOV:
              1261           ;GENERATE A RANDOM MOVE FOR THE PLAYER PACKET POI
              1262           ;INPUT AND OUTPUT:
              1263           ;B=CURRENT SWITCH C=LAST SWITCH
167F          1264           SYSSUK RANGED
167F FF       1264 +         RST  56
1680 77       1264 +         DEFB RANGED+1
              1264 +         IF   RANGED.EQ.INTPC
              1264 +         ENDIF
1681 20       1265           DEFB 32
1682 B7       1266           OR   A            ;TIME TO CHANGE DIRECTION?
1683 2808     1267           JR   Z,NEWMOV-$
1685 DD4601   1268           LD   B,(IX+LASTMV) ;USE LAST MOVE
1688 78       1269           LD   A,B
1689 CDAC16   1270           CALL MOVTST
168C C8       1271           RET  Z            ;LAST MOVE IS GOOD ENOUGH
168D          1272  NEWMOV:  SYSSUK RANGED
168D FF       1272 +         RST  56
168E 77       1272 +         DEFB RANGED+1
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

               1272 +         IF   RANGED.EQ.INTPC
               1272 +         ENDIF
168F 04        1273           DEFB 4
1690 47        1274           LD   B,A
1691 04        1275           INC  B
1692 3E80      1276           LD   A,80H
1694 07        1277  SHFTIT:  RLCA
1695 10FD      1278           DJNZ SHFTIT-$
1697 47        1279           LD   B,A
1698 3E08      1280  RANFIN:  LD   A,08H
169A CDAC16    1281           CALL MOVTST
169D 2002      1282           JR   NZ,ANYMOV-$
169F 47        1283           LD   B,A
16A0 C9        1284           RET
16A1 060F      1285  ANYMOV:  LD   B,0FH          ;TRY ALL MOVES
16A3 3E08      1286           LD   A,08H
16A5 CDAC16    1287           CALL MOVTST
16A8 47        1288           LD   B,A
16A9 C9        1289           RET
16AA           1290  MOVANY:
16AA 3E08      1291           LD   A,AMOVE
16AC           1292  MOVTST:
               1293           ;TEST THE NEW MOVE FOR VALIDITY
               1294           ;THE INPUTS AND OUTPUTS:
               1295           ;B=A SET OF MOVES TO BE TESTED (IS UNCHANGED)
               1296           ;C=UNCHANGED
               1297           ;A=FIRST MOVE TO TEST,VALUE OF GOOD MOVE ON OUTPU
               1298           ;DE,HL=RETURNED UNCHANGED
               1299           ;D=# ROTATES
               1300           ;Z FLAG=Z IF GOOD MOVE FOUND(A CONTAINS FIRST GOO
               1301           ;Z FLAG=NZ IF NO GOOD MOVES FOUND(IN B)
16AC D5        1302           PUSH DE
16AD 1608      1303           LD   D,8            ;INIT # ROTATES
16AF 0F        1304  ROTMSK:  RRCA                ;ROTATE TO NEXT MOVE
16B0 5F        1305           LD   E,A
16B1 A0        1306           AND  B
16B2 CDC016    1307           CALL CHKMOV         ;CHECK MOVE
16B5 7B        1308           LD   A,E
16B6 2806      1309           JR   Z,MOVEXT-$     ;FOUND ONE
16B8 15        1310           DEC  D              ;DEC # ROTATES
16B9 20F4      1311           JR   NZ,ROTMSK-$
16BB 37        1312           SCF                 ;NO GOOD MOVES
16BC CB12      1313           RL   D              ;SET Z FLAG=NZ
16BE D1        1314  MOVEXT:  POP  DE
16BF C9        1315           RET
16C0           1316  CHKMOV:
               1317           ;CHECK THE MOVE IN A FOR BEING UNOCCUPIED
               1318           ;INPUT AND OUTPUT:
               1319           ;A=UP,DOWM,RIGHT OR LEFT BIT (RETURNED UNCHANGED)
               1320           ;Z FLAG=Z IF MOVE IN A IS TO AN EMPTY POSITION
               1321           ;Z FLAG=NZ IF MOVE IN A IS BAD
               1322           ;BC,DE,HL RETURNED UNTOUCHED
               1323           ;IX=POINTER TO CURRENT PLAYER PACKET
               1324           ;LOCAL TO THIS ROUTINE:
               1325           ;    D=TEMP X COORD OF ARROW
               1326           ;    E=TEMP Y COORD OF ARROW
16C0 C5        1327           PUSH BC
```

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ADDR OBJECT    STMT   LABEL    OPCD OPERAND       COMMENT

16C1 D5        1328            PUSH DE
16C2 E5        1329            PUSH HL
16C3 F5        1330            PUSH AF
16C4 DD5604    1331            LD   D,(IX+ARRX)  ;GET X COORD OF ARROW
16C7 DD5E05    1332            LD   E,(IX+ARRY)  ;GET Y COORD OF ARROW
16CA CB57      1333   TLEFT:   BIT  CHLEFT,A
16CC 280A      1334            JR   Z,TRIGHT-$
16CE 7A        1335            LD   A,D          ;GOT A  LEFT MOVE
16CF FE00      1336            CP   LOWX
16D1 282F      1337            JR   Z,BADMOV-$   ;ALREADY AT LOWEST X
16D3 D604      1338            SUB  WIDTH        ;DEC TEMP X BY 1 POSITION
16D5 57        1339            LD   D,A
16D6 1830      1340            JR   LOOKSQ-$
16D8 CB5F      1341   TRIGHT:  BIT  CHRIGH,A
16DA 280A      1342            JR   Z,TUP-$
16DC 7A        1343            LD   A,D          ;GOT A RIGHT MOVE
16DD FE9C      1344            CP   XMAX
16DF 3021      1345            JR   NC,BADMOV-$  ;ALREADY GEQ MAX X
16E1 C604      1346            ADD  A,WIDTH
16E3 57        1347            LD   D,A
16E4 1822      1348            JR   LOOKSQ-$
16E6 CB47      1349   TUP:     BIT  CHUP,A
16E8 280A      1350            JR   Z,TDOWN-$
16EA 7B        1351            LD   A,E          ;GOT AN UP MOVE
16EB FE0B      1352            CP   LOWY
16ED 2813      1353            JR   Z,BADMOV-$   ;ALREADY AT LOWEST Y
16EF D604      1354            SUB  HEIGHT       ;DEC TEMP Y BY 1 POSITION
16F1 5F        1355            LD   E,A
16F2 1814      1356            JR   LOOKSQ-$
16F4 CB4F      1357   TDOWN:   BIT  CHDOWN,A
16F6 280A      1358            JR   Z,BADMOV-$
16F8 7B        1359            LD   A,E          ;GOT A DOWN MOVE
16F9 FE5B      1360            CP   YMAX
16FB 2805      1361            JR   Z,BADMOV-$   ;ALREADY AT HIGHEST Y
16FD C604      1362            ADD  A,HEIGHT     ;  INC TEMP Y BY 1 POSITION
16FF 5F        1363            LD   E,A
1700 1806      1364            JR   LOOKSQ-$
1702 F1        1365   BADMOV:  POP  AF
1703 37        1366            SCF
1704 CB12      1367            RL   D            ;SET Z FLAG = NZ
1706 1823      1368            JR   MOVEND-$
1708           1369   LOOKSQ:
               1370            ;SEE IF THE NEW SQUARE IS OCCUPIED
1708 D5        1371            PUSH DE
1709 D5        1372            PUSH DE
170A C1        1373            POP  BC
170B 51        1374            LD   D,C          ;REVERSE X,Y FOR SYSTEM
170C 58        1375            LD   E,B
170D           1376            SYSSUK RELAB1
170D FF        1376 +          RST  56
170E 3B        1376 +          DEFB RELAB1+1
               1376 +          IF   RELAB1.EQ.INTPC
               1376 +          ENDIF
170F 00        1377            DEFB 0
1710 E1        1378            POP  HL
1711 EB        1379            EX   DE,HL
1712 7E        1380            LD   A,(HL)
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

1713 B7        1381           OR   A              ;TEST SQUARE
1714 20EC      1382           JR   NZ,BADMOV-$
1716 012800    1383           LD   BC,BYTEPL
1719 09        1384           ADD  HL,BC
171A 7E        1385           LD   A,(HL)
171B B7        1386           OR   A
171C 20E4      1387           JR   NZ,BADMOV-$
171E 7A        1388           LD   A,D
171F 32A54F    1389           LD   (TARRX),A      ;STORE TEMP ARROW X COORD
1722 7B        1390           LD   A,E
1723 32A64F    1391           LD   (TARRY),A      ;STORE TEMP ARROW Y COORD
1726 F1        1392           POP  AF
1727 1600      1393           LD   D,0
1729 CB3A      1394           SRL  D              ;SET Z FLAG=Z
172B E1        1395  MOVEND:  POP  HL
172C D1        1396           POP  DE
172D C1        1397           POP  BC
172E C9        1398           RET
172F           1399  GETROT:
               1400           ;HL<-BASE ADDR OF ROTATED PATTERN
               1401           ;A<-DIRECTION OF ROTATION
               1402           ;IF A HAS MORE THAN 1 BIT SET THEN ONLY ONE IS US
172F 218A17    1403           LD   HL,AUP
1732 CB47      1404           BIT  CHUP,A
1734 C0        1405           RET  NZ
1735 219217    1406           LD   HL,ADOWN
1738 CB4F      1407           BIT  CHDOWN,A
173A C0        1408           RET  NZ
173B 218E17    1409           LD   HL,ARIGHT
173E CB5F      1410           BIT  CHRIGH,A
1740 C0        1411           RET  NZ
1741 219617    1412           LD   HL,ALEFT
1744 C9        1413           RET
               1414           ;START OF ROM DATA FOR EACH PLAYER.
               1415           ;CONTAINS: 4 PLAYER NOTES, PLAYER PATTERN ADDR
               1416           ;  , PLAYER CHAR DISP OPT
               1417           ;PLAYER SCORE DISP OPT
               1418           ;AND PLAYER SCORE POSITION
1745           1419  PLROM0:
1745           1420  PNOTE0:  DEF4X G0,GS0,A0,AS0
1745 FD        1420 +         DEFB G0
1746 EE        1420 +         DEFB GS0
1747 E1        1420 +         DEFB A0
1748 D4        1420 +         DEFB AS0
1749 9A17      1421  PPADR0:  DEFW PPAT0
174B 18        1422  PCDOP0:  DEFB 011000B
174C 04        1423  PSPOS0:  DEFB 4
174D 01        1424           DEFB 1
174E 18        1425  PSDOP0:  DEFB 011000B
174F           1426  PLROM1:
174F           1427  PNOTE1:  DEF4X B0,C1,CS1,D1
174F C8        1427 +         DEFB B0
1750 BD        1427 +         DEFB C1
1751 B2        1427 +         DEFB CS1
1752 A8        1427 +         DEFB D1
1753 9E17      1428  PPADR1:  DEFW PPAT1
1755 1C        1429  PCDOP1:  DEFB 011100B
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ADDR OBJECT   STMT  LABEL    OPCD OPERAND       COMMENT

1756 85       1430  PSPOS1:  DEFB 133
1757 01       1431           DEFB 1
1758 1C       1432  PSDOP1:  DEFB 011100B
1759          1433  PLROM2:
1759          1434  PNOTE2:  DEF4X DS1,E1,F1,FS1
1759 9F       1434 +         DEFB DS1
175A 96       1434 +         DEFB E1
175B 8D       1434 +         DEFB F1
175C 85       1434 +         DEFB FS1
175D A217     1435  PPADR2:  DEFW PPAT2
175F 1C       1436  PCDOP2:  DEFB 011100B
1760 2D01     1437  PSPOS2:  DEFW 45+1.SHL.8
1762 1C       1438  PSDOP2:  DEFB 011100B
1763          1439  PLROM3:
1763          1440  PNOTE3:  DEF4X G1,GS1,A1,AS1
1763 7E       1440 +         DEFB G1
1764 77       1440 +         DEFB GS1
1765 70       1440 +         DEFB A1
1766 6A       1440 +         DEFB AS1
1767 A617     1441  PPADR3:  DEFW PPAT3
1769 18       1442  PCDOP3:  DEFB 011000B
176A 5D01     1443  PSPOS3:  DEFW 93+1.SHL.8
176C 18       1444  PSDOP3:  DEFB 011000B
              1445           ;EXPLOSION PATTERNS
176D          1446  EXPATS:
176D          1447  EXPAT1:  DEF4X 0,00010100B,00010100B,0
176D 00       1447 +         DEFB 0
176E 14       1447 +         DEFB 00010100B
176F 14       1447 +         DEFB 00010100B
1770 00       1447 +         DEFB 0
1771          1448  EXPAT2:  DEF4X 0,01000101B,01010001B,0
1771 00       1448 +         DEFB 0
1772 45       1448 +         DEFB 01000101B
1773 51       1448 +         DEFB 01010001B
1774 00       1448 +         DEFB 0
1775          1449  EXPAT3:  DEF4X 00000101B,01000000B,00000001B,01010000B
1775 05       1449 +         DEFB 00000101B
1776 40       1449 +         DEFB 01000000B
1777 01       1449 +         DEFB 00000001B
1778 50       1449 +         DEFB 01010000B
1779          1450  EXPAT4:  DEF4X 00010001B,01000000B,00000001B,01000100B
1779 11       1450 +         DEFB 00010001B
177A 40       1450 +         DEFB 01000000B
177B 01       1450 +         DEFB 00000001B
177C 44       1450 +         DEFB 01000100B
177D          1451  EXPAT5:  DEF4X 0,0,0,0
177D 00       1451 +         DEFB 0
177E 00       1451 +         DEFB 0
177F 00       1451 +         DEFB 0
1780 00       1451 +         DEFB 0
              1452           ;EXPLOSION COLORS
1781          1453  EXCOLS:
1781 07       1454           DEFB 7
1782 03       1455           DEFB 3
1783 07       1456           DEFB 7
1784 03       1457           DEFB 3
1785 77       1458           DEFB 077H
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ADDR OBJECT   STMT   LABEL    OPCD OPERAND       COMMENT

              1459            ;COUNT DOWN DISPLAY PACKET
1786 0400     1460   CDCOLR:  DEFW 0100B+0.SHL.8
              1461            ;TIMER DISPLAY PACKET
1788 0180     1462   TDPACK:  DEFW 0001B+10000000B.SHL.8
              1463            ;ARROW ANIMATION PATTERNS FOR EACH ROTATION
178A          1464   AUP:
178A          1465            DEF4X 00010100B,01010101B,01000001B,0
178A 14       1465 +          DEFB 00010100B
178B 55       1465 +          DEFB 01010101B
178C 41       1465 +          DEFB 01000001B
178D 00       1465 +          DEFB 0
178E          1466   ARIGHT:
178E          1467            DEF4X 00010100B,00000101B,00000101B,00010100B
178E 14       1467 +          DEFB 00010100B
178F 05       1467 +          DEFB 00000101B
1790 05       1467 +          DEFB 00000101B
1791 14       1467 +          DEFB 00010100B
1792          1468   ADOWN:
1792          1469            DEF4X 0,01000001B,01010101B,00010100B
1792 00       1469 +          DEFB 0
1793 41       1469 +          DEFB 01000001B
1794 55       1469 +          DEFB 01010101B
1795 14       1469 +          DEFB 00010100B
1796          1470   ALEFT:
1796          1471            DEF4X 00010100B,01010000B,01010000B,00010100B
1796 14       1471 +          DEFB 00010100B
1797 50       1471 +          DEFB 01010000B
1798 50       1471 +          DEFB 01010000B
1799 14       1471 +          DEFB 00010100B
              1472            ;PLAYER PATTERNS
179A          1473   PPAT0:   DEF4X 00001000B,10101000B,00101010B,00100000B
179A 08       1473 +          DEFB 00001000B
179B A8       1473 +          DEFB 10101000B
179C 2A       1473 +          DEFB 00101010B
179D 20       1473 +          DEFB 00100000B
179E          1474   PPAT1:   DEF4X 11111111B,11000011B,11000011B,11111111B
179E FF       1474 +          DEFB 11111111B
179F C3       1474 +          DEFB 11000011B
17A0 C3       1474 +          DEFB 11000011B
17A1 FF       1474 +          DEFB 11111111B
17A2          1475   PPAT2:   DEF4X 00001100B,11111100B,00111111B,00110000B
17A2 0C       1475 +          DEFB 00001100B
17A3 FC       1475 +          DEFB 11111100B
17A4 3F       1475 +          DEFB 00111111B
17A5 30       1475 +          DEFB 00110000B
17A6          1476   PPAT3:   DEF4X 10101010B,10000010B,10000010B,10101010B
17A6 AA       1476 +          DEFB 10101010B
17A7 82       1476 +          DEFB 10000010B
17A8 82       1476 +          DEFB 10000010B
17A9 AA       1476 +          DEFB 10101010B
              1477            ;COLOR BLOCK
17AA          1478   CBLOCK:
17AA F8       1479            DEFB 0F8H
17AB F8       1480            DEFB 0F8H
17AC F8       1481            DEFB 0F8H
17AD F8       1482            DEFB 0F8H
17AE B5       1483            DEFB 0B5H
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

17AF 52        1484           DEFB 052H
17B0 F8        1485           DEFB 0F8H
17B1 77        1486           DEFB 077H
               1487           ;EXPLOSION SOUNDS
17B2           1488  EXPSND:  DEF8 0EFH,0FFH,3FH,0,0FFH,0FDH,0F5H,0F5H
17B2 EF        1488 +         DEFB 0EFH
17B3 FF        1488 +         DEFB 0FFH
17B4 3F        1488 +         DEFB 3FH
17B5 00        1488 +         DEFB 0
17B6 FF        1488 +         DEFB 0FFH
17B7 FD        1488 +         DEFB 0FDH
17B8 F5        1488 +         DEFB 0F5H
17B9 F5        1488 +         DEFB 0F5H
17BA           1489           DEF8 08FH,0EEH,3EH,0,0FFH,0FDH,0F5H,0F5H
17BA 8F        1489 +         DEFB 08FH
17BB EE        1489 +         DEFB 0EEH
17BC 3E        1489 +         DEFB 3EH
17BD 00        1489 +         DEFB 0
17BE FF        1489 +         DEFB 0FFH
17BF FD        1489 +         DEFB 0FDH
17C0 F5        1489 +         DEFB 0F5H
17C1 F5        1489 +         DEFB 0F5H
17C2           1490           DEF8 04EH,088H,38H,0,0FFH,0FDH,0F5H,0F5H
17C2 4E        1490 +         DEFB 04EH
17C3 88        1490 +         DEFB 088H
17C4 38        1490 +         DEFB 38H
17C5 00        1490 +         DEFB 0
17C6 FF        1490 +         DEFB 0FFH
17C7 FD        1490 +         DEFB 0FDH
17C8 F5        1490 +         DEFB 0F5H
17C9 F5        1490 +         DEFB 0F5H
17CA           1491           DEF8 048H,044H,34H,0,0FFH,0FDH,0F5H,0F5H
17CA 48        1491 +         DEFB 048H
17CB 44        1491 +         DEFB 044H
17CC 34        1491 +         DEFB 34H
17CD 00        1491 +         DEFB 0
17CE FF        1491 +         DEFB 0FFH
17CF FD        1491 +         DEFB 0FDH
17D0 F5        1491 +         DEFB 0F5H
17D1 F5        1491 +         DEFB 0F5H
17D2           1492           DEF8 0,0,0,0,0,0,0,0
17D2 00        1492 +         DEFB 0
17D3 00        1492 +         DEFB 0
17D4 00        1492 +         DEFB 0
17D5 00        1492 +         DEFB 0
17D6 00        1492 +         DEFB 0
17D7 00        1492 +         DEFB 0
17D8 00        1492 +         DEFB 0
17D9 00        1492 +         DEFB 0
17DA           1493           END

TOTAL ASSEMBLER ERRORS =
```

CROSS REFERENCE

LABEL	VALUE	REFERENCE
A0	00E1	-508 1421
A1	0070	-520 1441
A2	0037	-532
A3	001B	-544
A4	000D	-556
A5	0006	-562
ACTBIT	0007	-694 957 1117 1124 1186
ACTINT	000E	-225 811
ACTION	146C	-893 943
ACTIVE	0080	-692 900 905
ADOWN	1792	-1368 1406
ALEFT	1796	-1369 1412
ALKEYS	0214	-49 938
ALLBYT	0D20	-719 991 1103
ALLHUM	13B7	-821 844
AMOVE	0008	-678 1291
ANIARR	1600	-1105 1046 1222
ANIMAX	0003	-672
ANYMOV	16A1	-1198 1282
ARIGHT	178E	-1367 1409
AROT	0003	-687 970 1033 1188 1221
ARRX	0004	-688 814 816 818 820 862 1035 1043 1073 1191 1331
ARRY	0005	-689 863 1034 1045 1072 1190 1332
AS0	00D4	-509 1421
AS1	006A	-521 1441
AS2	0034	-533
AS3	001A	-545
AUP	178A	-1366 1403
B0	00C8	-510 1428
B1	0064	-522
B2	0031	-534
B3	0018	-546
BADMOV	1702	-1278 1337 1345 1353 1358 1361 1382 1387
BCDADD	0062	-277
BCDCHS	006A	-281
BCDDIV	0068	-280
BCDMUL	0066	-279
BCDNEG	006C	-282
BCDSUB	0064	-278
BEGRAM	4FCE	-594 753
BITSPL	00A0	-43
BLANK	002A	-243 1056 1056
BMUSIC	0012	-229
BUMPCK	15C6	-1071 1125
BUMPEM	15A3	-1051 1147
BYTEPL	0028	-42 673 697 719 720 1383
C1	00BD	-511 1428
C2	005E	-523
C3	002E	-535
C4	0017	-547
C5	000B	-557
C6	0005	-563

C7	0002	-566						
CALPIZ	148B	-909	948					
CBA	0009	-123						
CBB	0007	-121						
CBC	0006	-120						
CBD	0005	-119						
CBE	0004	-118						
CBFLAG	0008	-122						
CBH	000B	-125						
CBIXH	0003	-117						
CBIXL	0002	-116						
CBIYH	0001	-115						
CBIYL	0000	-114						
CBL	000A	-124						
CBLEN	0008	-725						
CBLOCK	17AA	-1372	777					
CDCOLR	1786	-1362						
CDOPT	0044	-681	923					
CDOWNL	1426	-882	930					
CHDOWN	0001	-111	1357	1407				
CHKMOV	16C0	-1229	1307					
CHLEFT	0002	-110	1333					
CHRDIS	0032	-248	868	868	872	872	925	925
CHRIGH	0003	-109	1341	1410				
CHTRIG	0004	-108						
CHUP	0000	-112	1349	1404				
CKNOPL	141E	-876	903					
CKSUM3	1418	-873						
CLEARF	14B4	-930	822	931				
CNOHUM	4FA4	-743	838	851	1115	1225		
CNOPL	4FA2	-741	786	787	846	853	1150	1229
CNT	4FDD	-611	935					
COLOL	0004	-168						
COLOR	0000	-164	1070					
COL1L	0005	-169						
COL1R	0001	-165						
COL2L	0006	-170						
COL2R	0002	-166						
COL3L	0007	-171						
COL3R	0003	-167						
COLBX	000B	-172						
COLLST	4FE8	-622						
COLSET	0018	-234	777					
CONCM	0008	-189						
CRASH	1533	-993	1029					
CS1	00B2	-512	1428					
CS2	0059	-524						
CS3	002C	-536						
CS4	0015	-548						
CS5	000A	-558						
CT0	4FD5	-602	1232					
CT1	4FD6	-603						
CT2	4FD7	-604						
CT3	4FD8	-605						
CT4	4FD9	-606						
CT5	4FDA	-607						
CT6	4FDB	-608						

CT7	4FDC	-609	761	830	1157	1160		
CTIMER	0203	-46						
CURSCR	4F96	-739	767	889	1129			
CURSW	0002	-686	999	1208	1209			
D1	00A8	-513	1428					
D2	0054	-525						
D3	0029	-537						
D4	0014	-549						
DABS	0072	-285						
DADD	006E	-283						
DECCTS	0010	-226						
DISNUM	0036	-250	826	826	1181	1181		
DISPSC	15E3	-1088	893	1134	1140			
DISTIM	0052	-267						
DOIT	0044	-260	940	940				
DOITB	0046	-261						
DONTD	13A1	-806						
DS1	009F	-514	1435					
DS2	004F	-526						
DS3	0027	-538						
DS4	0013	-550						
DS5	0009	-559						
DS6	0004	-564						
DSMG	0070	-284						
DURAT	4FEA	-624						
E1	0096	-515	1435					
E2	004A	-527						
E3	0025	-539						
E4	0012	-551						
EMUSIC	0014	-230	779	928	928			
END	00C0	-379	948	948				
ENDCHK	15D6	-1083	1153					
ENDRAM	4FC4	-752	753					
ENDSCR	4FF4	-632						
ERASE	1525	-987	1036	1074	1193			
EXCOLS	1781	-1355	1062					
EXLOOP	153E	-1000	1094					
EXPAT1	176D	-1354						
EXPAT2	1771	-1354						
EXPAT3	1775	-1354						
EXPAT4	1779	-1354						
EXPAT5	177D	-1354						
EXPATS	176D	-1353	1061					
EXPFIN	156D	-1026	1088					
EXPSND	17B2	-1382	1064					
F1	008D	-516	1435					
F2	0046	-528						
F3	0022	-540						
F4	0011	-552						
F5	0008	-560						
FILL	001A	-235	767	767	781	786	990	990
FIREIT	1340	-764	1161					
FIRSTC	2000	-40						
FNTSML	020D	-48	824	1179				
FNTSYS	0206	-47						
FORCEM	00F6	-716						
FPLAY	13B5	-820	842					

FS1	0085	-517	1435			
FS2	0042	-529				
FS3	0020	-541				
FS4	0010	-553				
FTBASE	0000	-93				
FTBYTE	0003	-96				
FTFSX	0001	-94				
FTFSY	0002	-95				
FTPTH	0006	-99				
FTPTL	0005	-98				
FTYSIZ	0004	-97				
G0	00FD	-506	1421			
G1	007E	-518	1441			
G2	003E	-530				
G3	001F	-542				
G4	000F	-554				
G5	0007	-561				
G6	0003	-565				
G7	0001	-567				
G8	0000	-568				
GAMSTB	4FF8	-634				
GETLM	1642	-1141	1211	1213	1216	
GETNUM	004E	-265				
GETPAR	004C	-264	759	759	763	763
GETROT	172F	-1310	1189			
GOTBIT	14A1	-919	974			
GOTIT	1645	-1142	1219			
GOTMOV	14F7	-971	1018	1021	1025	
GOTNPL	13AA	-812	835			
GOTSW	14DC	-956	1012			
GS0	00EE	-507	1421			
GS1	0077	-519	1441			
GS2	003B	-531				
GS3	001D	-543				
GS4	000E	-555				
GSBEND	0007	-62				
GSBSCR	0001	-61				
GSBTIM	0000	-60				
GTMINS	4FEE	-628				
GTPLIX	13C4	-831	911			
GTSECS	4FED	-627				
HEIGHT	0004	-718	1354	1362		
HORAF	000F	-195				
HORCB	0009	-173				
HUMAN	0040	-693	900			
HUMANR	0040	-257				
HUMBIT	0006	-695	1000	1113	1218	
HUMCHK	163C	-1139				
INCIX	146F	-897	958			
INCSCR	0054	-268	1137	1137		
INDEXB	005C	-274				
INDEXN	0056	-271				
INDEXW	005A	-273	1242	1242	1246	1246
INFBK	000D	-186				
INLIN	000F	-188				
INMOD	000E	-187				
INTIPP	13BA	-826				

INTPC	0000	-216	759	763	767	775	775	775	826
		868	872	883	916	925	926	928	938
		940	967	990	1042	1051	1056	1079	1080
		1137	1144	1163	1181	1198	1242	1246	1265
		1273	1377						
INTP@	0000	-768	-789						
INTST	0008	-193							
JUSJOY	000F	-724							
KCTASC	0040	-258							
KEY0	0014	-206							
KEY1	0015	-207							
KEY2	0016	-208							
KEY3	0017	-209							
KEYSEX	4FE3	-617							
KILLST	159D	-1048	1114						
LASTMV	0001	-685	1016	1026	1032	1210	1220	1268	
LASTSW	0000	-684	998	1009					
LDPLIX	165C	-1155	857	956	1123	1204			
LDPLIY	165C	-1156	969						
LOOKSQ	1708	-1282	1340	1348	1356	1364			
LOOPY	144F	-896	941						
LOWX	0000	-677	1336						
LOWY	000B	-675	676	701	702	703	720	790	1352
MAGIC	000C	-190							
MATH	0056	-270							
MCALL	0006	-219							
MENU	004A	-263							
MENUST	0218	-50							
MJUMP	000A	-221							
MOVANY	16AA	-1203	1020	1024	1028				
MOVE	005E	-275							
MOVEIT	14BC	-935	959						
MOVEND	172B	-1306	1368						
MOVEXT	16BE	-1227	1309						
MOVJOY	1484	-905	944	945	946	947			
MOVTST	16AC	-1205	1017	1270	1281	1287			
MRET	0008	-220							
MRFLOP	0006	-101							
MRLOCK	4FF7	-633							
MROR	0004	-103	1169						
MRROT	0002	-105							
MRSHFT	0003	-106							
MRXOR	0005	-102	1170						
MRXPND	0003	-104							
MSKTD	007E	-291							
MUSVOL	0009	-679	982						
MUZAK	0012	-228							
MUZPC	4FCE	-596							
MUZSP	4FD0	-597							
MXSCR	021E	-51							
NEGT	0074	-286							
NEWMOV	168D	-1187	1267						
NEWWAY	0001	-666							
NGBIT	0002	-670							
NOCUR	14CB	-946	1001						
NOGAME	0235	-53	759						
NOPLAY	0228	-52	763						

NORMEM	4000	-39	720	736					
NOTE0	0000	-705							
NOTE1	0001	-706							
NOTE2	0002	-707							
NOTE3	0003	-708							
NOTHUM	1419	-874	899						
NOTXOR	15EC	-1096	1168						
NPBIT	0003	-671							
NUMPLY	4FF3	-631	765	833					
NWHDWR	0001	-36	665						
OA1	008F	-576							
OA2	0047	-577							
OA3	0023	-578							
OA4	0011	-579	984						
OA5	0008	-580							
OB0	00FE	-570							
OC0	00F1	-571							
OD1	00D6	-572							
OE1	00BF	-573							
OF1	00B4	-574							
OG1	00A0	-575							
OLDWAY	0000	-665	666						
ONETIM	1328	-755							
OPOT0	4FDF	-613							
OPOT1	4FE0	-614							
OPOT2	4FE1	-615							
OPOT3	4FE2	-616							
OSW0	4FE4	-618	781						
OSW1	4FE5	-619							
OSW2	4FE6	-620							
OSW3	4FE7	-621							
PATDIM	0104	-723							
PATXSZ	0001	-721	723	878	1039	1054	1077	1195	
PATYSZ	0004	-722	723	878	1039	1054	1077	1195	
PAWS	0050	-266	916	916	926	926	1080	1080	1144
		1144							
PCDOP	0006	-711	866						
PCDOP0	174B	-1332							
PCDOP1	1755	-1338							
PCDOP2	175F	-1344							
PCDOP3	1769	-1349							
PIZBRK	0048	-262	967	967					
PLAY0	4FA8	-748	814	1256					
PLAY1	4FAF	-749	816	1257					
PLAY2	4FB6	-750	818	1258					
PLAY3	4FBD	-751	787	820	1259				
PLIX	4FA3	-742	917	952	955	968			
PLROM0	1745	-1330	1252						
PLROM1	174F	-1336	1253						
PLROM2	1759	-1342	1254						
PLROM3	1763	-1347	1255						
PNOTE0	1745	-1331							
PNOTE1	174F	-1337							
PNOTE2	1759	-1343							
PNOTE3	1763	-1348							
POT0	001C	-201							
POT1	001D	-202							

POT2	001E	-203							
POT3	001F	-204							
PPACKS	4FA8	-747							
PPADR0	1749	-1331							
PPADR1	1753	-1337							
PPADR2	175D	-1343							
PPADR3	1767	-1348							
PPAT0	179A	-1371	1421						
PPAT1	179E	-1371	1428						
PPAT2	17A2	-1371	1435						
PPAT3	17A6	-1371	1441						
PPATH	0005	-710	879	1037	1096				
PPATL	0004	-709	880	1038	1097				
PRIOR	4FF9	-635							
PSDOP	0009	-714	1167						
PSDOP0	174E	-1335							
PSDOP1	1758	-1341							
PSDOP2	1762	-1346							
PSDOP3	176C	-1351							
PSPOS0	174C	-1333							
PSPOS1	1756	-1339							
PSPOS2	1760	-1345							
PSPOS3	176A	-1350							
PSPOSX	0007	-712	868	1172					
PSPOSY	0008	-713	869	1173					
PSTAT	0006	-690	748	749	750	751	787	901	906
		957	1000	1113	1117	1124	1186	1218	
PSWCY	0000	-58							
PSWPV	0002	-57							
PSWSGN	0007	-55							
PSWZRO	0006	-56							
PVOLAB	4FD2	-598							
PVOLMC	4FD3	-599							
QUIT	0078	-288	1163	1163					
RAMTBL	1677	-1173	1246						
RANFIN	1698	-1193							
RANGED	0076	-287	1265	1265	1273	1273			
RANMOV	167F	-1177	1014						
RANSHT	4FEF	-630							
RANTST	14D0	-950	1007						
RCALL	0004	-218							
RECTAN	001C	-236	795	799	802	805	808		
RELAB1	003A	-253	1051	1051	1377	1377			
RELABS	0038	-252							
RESTOM	158E	-1041	1105						
RESTOR	002E	-245							
RLMOVE	000C	-668	1212	1214					
RMASK	4FA7	-746							
ROMTBL	166F	-1169	1242						
ROTMSK	16AF	-1217	1311						
RSTART	4FA1	-753							
SAVE	002C	-244							
SBLEN	0008	-726	1082						
SCHEDR	000C	-224							
SCREEN	0000	-41							
SCROLL	0030	-246							
SCRSTR	0016	-232							

SCT0	0001	-128	943	
SCT1	0002	-129		
SCT2	0003	-130		
SCT3	0004	-131		
SCT4	0005	-132		
SCT5	0006	-133		
SCT6	0007	-134		
SCT7	0008	-135		
SEMI4S	4FDE	-612		
SENFLG	4FFA	-636		
SENTRY	0042	-259	938	938
SETB	007A	-289		
SETOUT	0016	-233	790	
SETW	007C	-290		
SF0	0009	-136		
SF1	000A	-137		
SF2	000B	-138		
SF3	000C	-139		
SF4	000D	-140		
SF5	000E	-141		
SF6	000F	-142		
SF7	0010	-143		
SHFTIT	1694	-1190	1278	
SHIFTU	0060	-276		
SJ0	0015	-152	944	961
SJ1	0017	-154	945	
SJ2	0019	-156	946	
SJ3	001B	-158	947	
SKYD	0013	-145	948	
SKYU	0012	-146		
SNDBX	0018	-184	1082	
SNUL	0000	-127		
SP0	001C	-147		
SP1	001D	-148		
SP2	001E	-149		
SP3	001F	-150		
SSEC	0011	-144		
ST0	0014	-151		
ST1	0016	-153		
ST2	0018	-155		
ST3	001A	-157		
STALL	161E	-1120	963	
STARTS	41B8	-720	990	1102
STICK	1658	-1153	1228	
STIMER	0200	-45		
STLOOP	1585	-1035	1109	
STOMP	157C	-1032	1112	
STOREN	0058	-272		
STORIT	1628	-1130	1207	
STRDIS	0034	-249		
SUCK	000C	-222		
SW0	0010	-197		
SW1	0011	-198		
SW2	0012	-199		
SW3	0013	-200		
SYSRAM	4FCE	-639		
TARRX	4FA5	-744	1042	1389

TARRY	4FA6	-745	1044	1391	
TDOPT	0024	-680	828		
TDOWN	16F4	-1270	1350		
TDPACK	1788	-1364			
THETBL	1459	-898	940		
TICKIT	164A	-1144	933	949	965
TIMOUT	4FEC	-626			
TLEFT	16CA	-1246			
TMR60	4FEB	-625			
TONEA	0011	-177			
TONEB	0012	-178			
TONEC	0013	-179	981		
TONMO	0010	-176	985		
TRIGHT	16D8	-1254	1334		
TSTBIT	149C	-915	975		
TUP	16E6	-1262	1342		
UDMOVE	0003	-669	1215	1217	
UMARGT	4FFB	-637			
UNCRAM	4F96	-738	753	757	773
UPISTR	0000	-215			
UPMUZK	1491	-911	918	1047	
USERTB	4FFD	-638			
VBBLNK	0006	-87			
VBCCHK	0004	-84			
VBCH	0003	-83			
VBCL	0002	-82			
VBCLAT	0003	-91			
VBCLMT	0000	-89			
VBCREV	0001	-90			
VBDCH	0001	-81			
VBDCL	0000	-80			
VBDXH	0004	-68			
VBDXL	0003	-67			
VBDYH	0009	-73			
VBDYL	0008	-72			
VBLANK	0028	-242			
VBMR	0000	-64			
VBOAH	000E	-78			
VBOAL	000D	-77			
VBSACT	0007	-86			
VBSTAT	0001	-65			
VBTIMB	0002	-66			
VBXCHK	0007	-71			
VBXH	0006	-70			
VBXL	0005	-69			
VBYCHK	000C	-76			
VBYH	000B	-75			
VBYL	000A	-74			
VECT	003E	-255			
VECTC	003C	-254			
VERAF	000E	-194			
VERBL	000A	-174			
VIBRA	0014	-180			
VOICES	4FD4	-600			
VOLAB	0016	-181			
VOLC	0015	-182	983		
VOLN	0017	-183			

VWRITR	001E	-237							
WASTE	0FFF	-585							
WASTER	0FFF	-586							
WIDTH	0004	-717	1338	1346					
WPONOF	0000	-727							
WPOPT	0001	-728							
WPPAH	0003	-730							
WPPAL	0002	-729							
WPXSIZ	0005	-731							
WPYSIZ	0004	-732							
WRIT	0024	-240	883	883	1042	1042	1079	1079	1198
		1198							
WRITA	0026	-241							
WRITOR	0010	-682	1040	1076	1196				
WRITP	0022	-239							
WRITR	0020	-238							
XINTC	0002	-217	812						
XMAX	009C	-673	1344						
XPAND	0019	-191							
XPNDON	0001	-35							
XTAB1	0028	-697	698	699	813				
XTAB2	0050	-698	817	819					
XTAB3	0078	-699	815						
YLINES	0015	-674	676	700	719	790			
YMAX	005B	-676	1360						
YTAB	0014	-700	701	702	703				
YTAB1	001F	-701	817						
YTAB2	0033	-702	813	815					
YTAB3	0047	-703	819						
ZSW	14C8	-943							

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

               641
               642            LIST S,M,X,T
               643            ORG  17DEH
17DE C3E819    644            JP   INIT

               646   ; *********************
               647   ; * GUN FIGHT EQUATES *
               648   ; *********************
               649    ; GUNFIGHT BACKGROUND JOB
               650    ; CONSISTING OF INITIALIZATION, PRE-ROUND DISPLAY,
               651    ; MONITORING OF CONTROLS AND VECTOR DELTA CHANGING
               652    ; DEATH, POST ROUND STUFF AND END GAME

               654     ;EQUATES
>0008          655   LNX      EQU  8              ; LEFT NUMBER X
>0002          656   BSY      EQU  2              ; BANNER STRINGS Y
>0088          657   RNX      EQU  136            ; RIGHT NUMBER X
>0020          658   LBULX    EQU  32             ; LEFT BULLETS X
>0068          659   RBULX    EQU  104            ; RIGHT " "
>004C          660   STMRX    EQU  76             ; SUB TIMER X
>002C          661   GRX      EQU  44             ; GET READY X
>0001          662   GRY      EQU  1              ; " Y
>0040          663   DRX      EQU  64             ; DRAW X
>0014          664   TCACY    EQU  20             ; TOP CACTUS Y
>000F          665   TTREEY   EQU  TCACY-5
>002A          666   MCACY    EQU  42             ; MID CACTUS Y
>0046          667   BCACY    EQU  70             ; BOTTOM CACTUS Y
>0041          668   BTREEY   EQU  BCACY-5
>0040          669   LCACX    EQU  64             ; LEFT CACTUS X
>0058          670   RCACX    EQU  88             ; RIGHT CACTUS X
>004C          671   CCACX    EQU  76             ; CENTER CACTUS X
>0048          672   WAGX     EQU  72             ; WAGON X
>0060          673   COWX     EQU  RCACX+8        ; OTHER COWBOYS WINDOW X
               674   ;
>000A          675   TLINE    EQU  10             ; TOP LINE OF GUNSPACE
>0009          676   ALINE    EQU  TLINE-1
>005C          677   BLINE    EQU  92             ; BOTTOM LINE OF "
               678   ;
>0012          679   BULVSZ   EQU  18             ; BULLET VECTOR SIZE
>0017          680   GFVSIZ   EQU  23
>0012          681   WAGVSZ   EQU  18             ; WAGON VECTOR SIZE
               682   ;
>0032          683   WINBND   EQU  50             ; TOP-BOTTOM WINDOW BOUNDARY
>006A          684   TOPLIN   EQU  53*2           ; TOP WINDOW LINE
>0000          685   BOTLIN   EQU  00             ; BOTTOM WINDOW LINE
>00C8          686   LFRLIN   EQU  100*2          ; LOW PRIORITY FOREGROUND LINE
               687   ;
>FFFF          688   NEXT     EQU  -1             ; NEXT LINK FOR QUEUES
>000F          689   VBARM    EQU  VBOAH+1        ; ARM STATE
>0010          690   VBOARM   EQU  VBARM+1        ; LAST ARM PATTERN WRITTEN
>0011          691   VBLEGT   EQU  VBOARM+1       ; LEG TIMER
>0012          692   VBLEG    EQU  VBLEGT+1       ; LEG LINK
>0013          693   VBCOMP   EQU  VBLEG+1        ; TIMER FOR COMPUTER CONTROL
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

                694  ; BITS
>0000           695  VBSWAG   EQU  0             ; WAGON BIT
>0003           696  VBSCHG   EQU  3             ; CHANGE STATUS BIT
>0004           697  VBSNOM   EQU  4             ; NOT MOVING STATUS
>0005           698  VBSINT   EQU  5             ; INTERCEPTED/DEAD STATUS



                700  ; ***************
                701  ; * SUBROUTINES *
                702  ; ***************
                703  ; DISPLAY CLOCK AND UPDATE CT4
17E1 F3         704  DCLOCK   DI
17E2            705           SYSSUK DECCTS
17E2 FF         705 +         RST  56
17E3 11         705 +         DEFB DECCTS+1
                705 +         IF   DECCTS.EQ.INTPC
                705 +         ENDIF
17E4 80         706           DEFB 10000000B
17E5 DD210D02   707           LD   IX,FNTSML
17E9 3ADC4F     708           LD   A,(CT7)
17EC B7         709           OR   A
17ED 2808       710           JR   Z,DCOUT-$
17EF            711           SYSSUK DISNUM
17EF FF         711 +         RST  56
17F0 37         711 +         DEFB DISNUM+1
                711 +         IF   DISNUM.EQ.INTPC
                711 +         ENDIF
17F1 4C         712           DEFB STMRX
17F2 02         713           DEFB BSY
17F3 0B         714           DEFB TIME
17F4 42         715           DEFB 42H
17F5 DC4F       716           DEFW CT7
17F7 AF         717  DCOUT    XOR  A
17F8 D30C       718           OUT  (MAGIC),A
17FA 32FF0F     719           LD   (WASTE),A
17FD FB         720           EI
17FE C9         721           RET
                722  ; FIRE BULLETS
                723  ; LEFT COWBOY
17FF            724  FIRE0    SYSSUK SUCK
17FF FF         724 +         RST  56
1800 0D         724 +         DEFB SUCK+1
                724 +         IF   SUCK.EQ.INTPC
                724 +         ENDIF
1801 DC         725           DEFB 11011100B
1802 614F       726           DEFW LCOWB
1804 DA4F       727           DEFW LBULS
1806 194F       728           DEFW BULV1+1
1808 1809       729           JR   ZORE-$
180A            730  FIRE1    SYSSUK SUCK
180A FF         730 +         RST  56
180B 0D         730 +         DEFB SUCK+1
                730 +         IF   SUCK.EQ.INTPC
                730 +         ENDIF
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

180C DC         731           DEFB 11011100B
180D 784F       732           DEFW RCOWB
180F DB4F       733           DEFW RBULS
1811 3D4F       734           DEFW BULV3+1
1813 FD7E07     735  ZORE:    LD   A,(IY+CBB)
1816 B7         736           OR   A
1817 C8         737           RET  Z
1818 0A         738           LD   A,(BC)        ; GET BULLET COUNT
1819 B7         739           OR   A
181A C8         740           RET  Z
181B 7E         741           LD   A,(HL)        ; CHECK IF BULLET IS AVAILABLE
181C B7         742           OR   A
181D 2809       743           JR   Z,ZOK-$
181F 111200     744           LD   DE,BULVSZ     ; DELTA TO NEXT BULLET
1822 19         745           ADD  HL,DE
1823 7E         746           LD   A,(HL)
1824 B7         747           OR   A
1825 2801       748           JR   Z,ZOK-$
1827 C9         749           RET
                750  ; NOW HL->BULLET
                751  ;      IX->COWBOY
                752  ; SUB 1 FROM BULLET COUNT
1828 0A         753  ZOK      LD   A,(BC)
1829 3D         754           DEC  A
182A 02         755           LD   (BC),A
                756  ; SET SUB TIMER IF OUT OF BULLETS
182B 200D       757           JR   NZ,BERASE-$
182D 3ADC4F     758           LD   A,(CT7)
1830 B7         759           OR   A
1831 3E10       760           LD   A,10H
1833 2802       761           JR   Z,STSEC-$
1835 3E02       762           LD   A,2
1837 32DC4F     763  STSEC    LD   (CT7),A
183A E5         764  BERASE   PUSH HL
183B DDE5       765           PUSH IX
183D 0A         766           LD   A,(BC)
183E 6F         767           LD   L,A
183F 2600       768           LD   H,0
1841 29         769           ADD  HL,HL
1842 29         770           ADD  HL,HL         ;*4
1843 116802     771           LD   DE,BSY*256+RBULX
1846 DDCB0076   772           BIT  MRFLOP,(IX+VBMR)
184A 3E40       773           LD   A,40H         ; FLOPED MR
184C 2801       774           JR   Z,RITB-$
184E AF         775           XOR  A             ; NORMAL MR
                776  ; NOW POSITION AND ERASE
184F 19         777  RITB     ADD  HL,DE
1850 EB         778           EX   DE,HL
1851            779           SYSTEM RELAB1
1851 FF         779 +         RST  56
1852 3A         779 +         DEFB RELAB1
                779 +         IF   RELAB1.EQ.INTPC
                779 +         ENDIF
1853 EB         780           EX   DE,HL
1854 0605       781           LD   B,5
1856 112800     782           LD   DE,40         ; INC TO NEXT LINE
1859 36FF       783  BELP     LD   (HL),0FFH     ;ERASE A LINE
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```
ADDR OBJECT   STMT  LABEL    OPCD OPERAND        COMMENT

185B 19        784           ADD  HL,DE          ; GO DOWN A LINE
185C 10FB      785           DJNZ BELP-$
185E 1600      786           LD   D,0
1860 DD5E0F    787           LD   E,(IX+VBARM)   ; GET CURRENT ARM POS
1863 62        788           LD   H,D
1864 6B        789           LD   L,E
1865 29        790           ADD  HL,HL          ;*2
1866 19        791           ADD  HL,DE          ; *3
1867 11931D    792           LD   DE,BULTAB
186A 19        793           ADD  HL,DE          ; -> BULTAB(ARM)
186B EB        794           EX   DE,HL
186C C1        795           POP  BC             ; BC<==IX
186D E1        796           POP  HL             ; BUL [STAT]
186E E5        797           PUSH HL             ; SAVE FOR ACTIVATE
186F 23        798           INC  HL             ; BUL [DEL TIME]
1870 3601      799           LD   (HL),1         ; MAKE BULIT JUMP OUT
1872 23        800           INC  HL             ; BUL [DEL XLOW]
1873 03        801           INC  BC             ; COW [STAT]
1874 03        802           INC  BC             ; COW [DEL TIME]
1875 03        803           INC  BC             ; COW [DX LO]
1876 CDD319    804           CALL PUTVEC
1879 03        805           INC  BC             ; COW [XCHK]
187A 03        806           INC  BC             ; COW [DY LO]
187B 23        807           INC  HL             ; BUL [XCHK]
187C 3601      808           LD   (HL),1         ; LIMIT CHECK
187E 23        809           INC  HL             ; BUL [DY LO]
187F CDD319    810           CALL PUTVEC
1882 E1        811           POP  HL             ; BUL [STAT]
1883 3680      812           LD   (HL),80H       ; ACTIVE
1885           813           SYSSUK BMUSIC
1885 FF        813 +         RST  56
1886 13        813 +         DEFB BMUSIC+1
               813 +         IF   BMUSIC.EQ.INTPC
               813 +         ENDIF
1887 124F      814           DEFW MSTACK
1889 01        815           DEFB 00000001B      ; JUST NOISE
188A DB1F      816           DEFW GUNSHOT
188C C9        817           RET
               818  ; TAKE A COFFEE BREAK
188D           819  NBRK:    DONT PIZBRK         ; SEE IF I CARE
188D 48        819 +         DEFB PIZBRK
188E           820           DO   MRET
188E 09        820 +         DEFB MRET+1
               821  ; CONVERT JOYSTICKS
188F DD21614F  822  JOY0     LD   IX,LCOWB
1893 1804      823           JR   PJOY-$
1895 DD21784F  824  JOY1     LD   IX,RCOWB
               825  ;   CONVERT  JOYSTICKS
1899 DD4E00    826  PJOY:    LD   C,(IX+VBMR)
189C 118000    827           LD   DE,128
189F 218000    828           LD   HL,128
18A2           829           SYSTEM MSKTD        ; COMPUTE DELTAS
18A2 FF        829 +         RST  56
18A3 7E        829 +         DEFB MSKTD
               829 +         IF   MSKTD.EQ.INTPC
               829 +         ENDIF
18A4 DD7409    830  STHN     LD   (IX+VBDYH),H
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

18A7 DD7508     831           LD   (IX+VBDYL),L
18AA DD7204     832           LD   (IX+VBDXH),D
18AD DD7303     833           LD   (IX+VBDXL),E
18B0 C9         834           RET
18B1 DD21784F   835  PPOT1:   LD   IX,RCOWB
18B5 78         836           LD   A,B             ; POT MUST BE FLOPPED BECAUSE
18B6 2F         837           CPL                  ; ARM IS FLOPPED
18B7 1805       838           JR   PPOT-$
18B9 DD21614F   839  PPOTO:   LD   IX,LCOWB
18BD 78         840           LD   A,B
                841  ; CONVERT POT AND STORE
18BE E6E0       842  PPOT     AND  0E0H
18C0 0F         843           RRCA
18C1 0F         844           RRCA
18C2 0F         845           RRCA
18C3 0F         846           RRCA
18C4 FE0E       847           CP   0EH
18C6 2002       848           JR   NZ,KART-$
18C8 3E0C       849           LD   A,0CH           ; IF KNOB=7 THEN SET TO 6
18CA DD770F     850  KART     LD   (IX+VBARM),A ;  SET ARM POSITION
18CD C9         851           RET
                852  ; CHECK IF BULLET HIT ANYTHING
18CE DD7E01     853  HITCHK:  LD   A,(IX+VBSTAT)
18D1 E660       854           AND  060H
18D3 FE20       855           CP   20H             ; CHECK ONLY IF BLANKED
18D5 280F       856           JR   Z,HIT-$
18D7 D0         857           RET  NC              ; RETURN IF NOT BLANKED YET
18D8 DDCB075E   858           BIT  VBCLAT,(IX+VBXCHK)
18DC C8         859           RET  Z
18DD DD360100   860           LD   (IX+VBSTAT),0 ;  BULLET HIT WALL
18E1 DD360701   861           LD   (IX+VBXCHK),1 ;  SET LIMIT CHECK
18E5 C9         862           RET
18E6 DD7E06     863  HIT:     LD   A,(IX+VBXH)    ;CHECK WHAT PART OF SCR ITS IN
18E9 FE48       864           CP   WAGX
18EB 300E       865           JR   NC,HIT1-$
18ED DD360202   866           LD   (IX+VBTIMB),2 ;MAKE IT JUMP OUT
18F1 DD360180   867           LD   (IX+VBSTAT),80H ;RE ACTIVATE
18F5 218F1D     868           LD   HL,BULLMT
18F8            869           SYSTEM VECT
18F8 FF         869 +         RST  56
18F9 3E         869 +         DEFB VECT
                869 +         IF   VECT.EQ.INTPC
                869 +         ENDIF
18FA C9         870           RET
18FB DD360100   871  HIT1:    LD   (IX+VBSTAT),0 ;  BULIT DIES FROM WAGON ON
18FF FE58       872           CP   RCACX
1901 301D       873           JR   NC,HIT2-$
1903 3A904F     874           LD   A,(WAGON)
1906 B7         875           OR   A               ; IS IT A CACTII?
1907 C0         876           RET  NZ              ; NOPE ITS A WAGON
1908 1E4C       877           LD   E,CCACX         ; LOAD X
                878  ; ERASE OBJECT BULLET HITS
190A DD560B     879  ERASE    LD   D,(IX+VBYH)    ; LOAD Y
190D 15         880           DEC  D
190E            881           SYSSUK RELAB1
190E FF         881 +         RST  56
190F 3B         881 +         DEFB RELAB1+1
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ADDR OBJECT    STMT  LABEL   OPCD OPERAND        COMMENT

                881 +         IF   RELAB1.EQ.INTPC
                881 +         ENDIF
1910 00         882           DEFB 0
1911 EB         883           EX   DE,HL
1912 11D7FF     884           LD   DE,-41
1915 0600       885           LD   B,0
1917 7E         886  ELOP     LD   A,(HL)
1918 70         887           LD   (HL),B         ;ZERO THE SCREEN BYTE
1919 23         888           INC  HL
191A B6         889           OR   (HL)
191B 70         890           LD   (HL),B
191C 19         891           ADD  HL,DE
191D 20F8       892           JR   NZ,ELOP-$
191F C9         893           RET
1920 FE60       894  HIT2:    CP   RCACX+8        ; GUNFTR SPACE
1922 300C       895           JR   NC,DIE-$
1924 1E40       896           LD   E,LCACX
1926 DDCB0076   897           BIT  MRFLOP,(IX+VBMR)
192A 20DE       898           JR   NZ,ERASE-$
192C 1E58       899           LD   E,RCACX
192E 18DA       900           JR   ERASE-$
1930 DDCB0076   901  DIE:     BIT  MRFLOP,(IX+VBMR) ; WHO DIED?
1934 280C       902           JR   Z,DLEFT-$
1936            903           SYSSUK SUCK
1936 FF         903 +         RST  56
1937 0D         903 +         DEFB SUCK+1
                903 +         IF   SUCK.EQ.INTPC
                903 +         ENDIF
1938 DD         904           DEFB 11011101B
1939 614F       905           DEFW LCOWB
193B 08         906           DEFB 8
193C B11F       907           DEFW TAPS
193E A64F       908           DEFW RSCORE
1940 180A       909           JR   DIE1-$
1942            910  DLEFT    SYSSUK SUCK
1942 FF         910 +         RST  56
1943 0D         910 +         DEFB SUCK+1
                910 +         IF   SUCK.EQ.INTPC
                910 +         ENDIF
1944 DD         911           DEFB 11011101B
1945 784F       912           DEFW RCOWB
1947 64         913           DEFB 100
1948 C11F       914           DEFW FUNERL
194A A24F       915           DEFW LSCORE
194C DD361106   916  DIE1:    LD   (IX+VBLEGT),6 ; SET FIRST CELL TIME
1950 DD361284   917           LD   (IX+VBLEG),KIL1.AND.OFFH ;??
1954 DD360168   918           LD   (IX+VBSTAT),068H ; KILL HIM
1958 DD7E0B     919           LD   A,(IX+VBYH)   ;  WHERE TO WRITE GOT ME
195B D608       920           SUB  8
195D FE13       921           CP   TLINE+9
195F 3002       922           JR   NC,DIE4-$
1961 C620       923           ADD  A,32
1963 57         924  DIE4     LD   D,A            ; LOAD Y
1964            925           SYSTEM INCSCR
1964 FF         925 +         RST  56
1965 54         925 +         DEFB INCSCR
                925 +         IF   INCSCR.EQ.INTPC
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ADDR OBJECT   STMT  LABEL   OPCD OPERAND        COMMENT

               925 +        ENDIF
1966 2B        926          DEC  HL
1967 7E        927          LD   A,(HL)         ; FIELD
1968 FE05      928          CP   5              ; INC IF LESS THAN 5
196A CE00      929          ADC  A,0
196C 77        930          LD   (HL),A
               931  ; PLAY DEATH SONG
196D 60        932          LD   H,B
196E 69        933          LD   L,C
196F DD21124F  934          LD   IX,MSTACK
1973 3EC0      935          LD   A,11000000B
1975           936          SYSTEM BMUSIC
1975 FF        936 +        RST  56
1976 12        936 +        DEFB BMUSIC
               936 +        IF   BMUSIC.EQ.INTPC
               936 +        ENDIF
1977 0E0C      937          LD   C,LARG2
1979 21061F    938          LD   HL,GOTME
197C F3        939          DI
197D           940          SYSTEM STRDIS
197D FF        940 +        RST  56
197E 34        940 +        DEFB STRDIS
               940 +        IF   STRDIS.EQ.INTPC
               940 +        ENDIF
197F           941          SYSSUK PAWS
197F FF        941 +        RST  56
1980 51        941 +        DEFB PAWS+1
               941 +        IF   PAWS.EQ.INTPC
               941 +        ENDIF
1981 FA        942          DEFB 250
1982 3E01      943          LD   A,1
1984 32DE4F    944          LD   (SEMI4S),A    ; SET FLAGO
1987 C9        945          RET
               946  ; FIELD PUTS UP THE CACTII APPROP TO SCORE
               947  ; A=SCORE OF OPP PLAYER UPTO 6
               948  ; BC -> ARRAY OF Y POSITIONS
1988 21F81E    949  FIELD:  LD   HL,CACTUS      ; -> CACTUS PATTERN
198B F5        950          PUSH AF
198C 3E08      951          LD   A,1000B
198E D319      952          OUT  (XPAND),A
1990 F1        953          POP  AF
1991 FE01      954          CP   1
1993 D8        955          RET  C
1994 FE04      956          CP   4
1996 3003      957          JR   NC,TCAC-$
1998 CDC819    958          CALL CACW
199B 03        959  TCAC    INC  BC
199C FE02      960          CP   2
199E D8        961          RET  C
199F FE05      962          CP   5
19A1 3003      963          JR   NC,MCAC-$
19A3 CDC819    964          CALL CACW
19A6 FE03      965  MCAC    CP   3
19A8 D8        966          RET  C
19A9 03        967          INC  BC
19AA 08        968          EX   AF,AF'
19AB 3E81      969          LD   A,81H          ; ACTIVATE WAGON
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

19AD 32904F     970           LD   (WAGON),A
19B0 08         971           EX   AF,AF'
19B1 CDC819     972           CALL CACW
19B4 FE04       973           CP   4
19B6 D8         974           RET  C
19B7 03         975           INC  BC
19B8 21E91D     976           LD   HL,TREE
19BB F5         977           PUSH AF
19BC 3E0C       978           LD   A,1100B
19BE D319       979           OUT  (XPAND),A
19C0 F1         980           POP  AF
19C1 CDC819     981           CALL CACW
19C4 FE05       982           CP   5
19C6 D8         983           RET  C
19C7 03         984           INC  BC
19C8 F5         985  CACW:    PUSH AF
19C9 D5         986           PUSH DE
19CA 0A         987           LD   A,(BC)
19CB 57         988           LD   D,A
19CC 3E08       989           LD   A,8            ; EXPAND
19CE            990           SYSTEM WRITP
19CE FF         990 +         RST  56
19CF 22         990 +         DEFB WRITP
                990 +         IF   WRITP.EQ.INTPC
                990 +         ENDIF
19D0 D1         991           POP  DE
19D1 F1         992           POP  AF
19D2 C9         993           RET
                994  ; PUT DEL X,Y INTO BULLET VECTORS
19D3 1A         995  PUTVEC   LD   A,(DE)         ; TABLE [D LO]
19D4 77         996           LD   (HL),A         ; BUL [D LO]
19D5 13         997           INC  DE             ; TAB [D HI]
19D6 03         998           INC  BC             ; COW [D HI]
19D7 23         999           INC  HL             ; BUL [D HI]
19D8 1A        1000           LD   A,(DE)
19D9 77        1001           LD   (HL),A
19DA 23        1002           INC  HL             ; BUL [LO]
19DB 13        1003           INC  DE             ; TAB [HI]
19DC 03        1004           INC  BC             ; COW [LO]
19DD 3600      1005           LD   (HL),0
19DF 03        1006           INC  BC             ; COW [HI]
19E0 23        1007           INC  HL             ; BUL [HI]
19E1 0A        1008           LD   A,(BC)
19E2 EB        1009           EX   DE,HL
19E3 86        1010           ADD  A,(HL)
19E4 EB        1011           EX   DE,HL
19E5 77        1012           LD   (HL),A         ; BUL [HI]=COW [HI]+TAB [HI]
19E6 13        1013           INC  DE             ; TAB [D HI]
19E7 C9        1014           RET
```

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ADDR OBJECT   STMT  LABEL    OPCD OPERAND          COMMENT

              1016  ; GUNFIGHT START UP ROUTINE (ONCE PER GAME)
19E8          1017  INIT:    SYSSUK GETPAR
19E8 FF       1017 +         RST  56
19E9 4D       1017 +         DEFB GETPAR+1
              1017 +         IF   GETPAR.EQ.INTPC
              1017 +         ENDIF
19EA 1E02     1018           DEFW MXSCR
19EC 84       1019           DEFB 84H
19ED F44F     1020           DEFW ENDSCR
19EF 31064F   1021           LD   SP,STACK
19F2          1022           SYSTEM INTPC
19F2 FF       1022 +         RST  56
19F3 00       1022 +         DEFB INTPC
              1022 +         IF   INTPC.EQ.INTPC
>0001         1022 +INTP@    DEFL 1
              1022 +         ENDIF
19F4          1023           DO   FILL
19F4 1B       1023 +         DEFB FILL+1
19F5 064F     1024           DEFW STACK
19F7 D600     1025           DEFW CT7-STACK
19F9 00       1026           DEFB 0
19FA          1027           DO   SETB
19FA 7B       1027 +         DEFB SETB+1
19FB 02       1028           DEFB 2**GSBSCR
19FC F84F     1029           DEFW GAMSTB
19FE          1030           DO   SETOUT          ; SET UP GAME PORTS
19FE 17       1030 +         DEFB SETOUT+1
19FF B8       1031           DEFB BLINE*2        ; BOTTOM LINE - VERT BLK
1A00 D6       1032           DEFB RCACX/4+0C0H ; HORZ BOUNDS
1A01 08       1033           DEFB 8              ; INMOD
1A02          1034           DO   COLSET
1A02 19       1034 +         DEFB COLSET+1
1A03 C71D     1035           DEFW GFCOLS
1A05          1036           DO   BMUSIC          ; PLAY STREETS OF LOREDO
1A05 13       1036 +         DEFB BMUSIC+1
1A06 124F     1037           DEFW MSTACK
1A08 C0       1038           DEFB 11000000B      ; ON VOICE A
1A09 A31F     1039           DEFW HOME
1A0B          1040           EXIT
1A0B 02       1040 +         DEFB XINTC
>0000         1040 +INTP@    DEFL 0
              1041  ; *****
              1042  ; ONCE A ROUND START UP ROUTINE
              1043  ; *****
1A0C F3       1044  STRND:   DI
1A0D          1045           SYSTEM INTPC
1A0D FF       1045 +         RST  56
1A0E 00       1045 +         DEFB INTPC
              1045 +         IF   INTPC.EQ.INTPC
>0001         1045 +INTP@    DEFL 1
              1045 +         ENDIF
              1046  ; INIT HANDLES,BULLETS,TIMERS
1A0F          1047           DO   MOVE
1A0F 5F       1047 +         DEFB MOVE+1
1A10 DA4F     1048           DEFW CT5
1A12 0C00     1049           DEFW 12
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

1A14 CF1D      1050           DEFW SINIT
               1051  ; COLOR BANNER
1A16           1052           FILL? NORMEM,BYTEPL*ALINE,OFFH
1A16 1B        1052 +         DEFB FILL+1
1A17 0040      1052 +         DEFW NORMEM
1A19 6801      1052 +         DEFW BYTEPL*ALINE
1A1B FF        1052 +         DEFB OFFH
               1053  ; ERASE SCREEN
1A1C           1054           FILL? NORMEM+BYTEPL*ALINE,BYTEPL*(BLINE-ALINE),0
1A1C 1B        1054 +         DEFB FILL+1
1A1D 6841      1054 +         DEFW NORMEM+BYTEPL*ALINE
1A1F F80C      1054 +         DEFW BYTEPL*(BLINE-ALINE)
1A21 00        1054 +         DEFB 0
               1055  ; RESET VECTORS
1A22           1056           FILL? STRRAM,ENDRAM-STRRAM,0
1A22 1B        1056 +         DEFB FILL+1
1A23 124F      1056 +         DEFW STRRAM
1A25 8F00      1056 +         DEFW ENDRAM-STRRAM
1A27 00        1056 +         DEFB 0
               1057  ; SHOW SCORES
1A28           1058           DO   SUCK
1A28 0D        1058 +         DEFB SUCK+1
1A29 10        1059           DEFB 00010000B     ; IX
1A2A 0D02      1060           DEFW FNTSML
1A2C           1061           DO   DISNUM
1A2C 37        1061 +         DEFB DISNUM+1
1A2D 08        1062           DEFB LNX
1A2E 02        1063           DEFB BSY
1A2F 0B        1064           DEFB TIME
1A30 C4        1065           DEFB OC4H          ;ZERO SUPRS,SMALL
1A31 A24F      1066           DEFW LSCORE
1A33           1067           DO   DISNUM
1A33 37        1067 +         DEFB DISNUM+1
1A34 88        1068           DEFB RNX
1A35 02        1069           DEFB BSY
1A36 0B        1070           DEFB TIME
1A37 C4        1071           DEFB OC4H
1A38 A64F      1072           DEFW RSCORE
               1073  ; CHECK FOR END GAME
1A3A           1074           DO   RCALL
1A3A 05        1074 +         DEFB RCALL+1
1A3B 301B      1075           DEFW ENDGAM
1A3D           1076           TEXT GETRDY,GRX,GRY,LARGE
1A3D 35        1076 +         DEFB STRDIS+1
1A3E 2C        1076 +         DEFB GRX
1A3F 01        1076 +         DEFB GRY
1A40 0B        1076 +         DEFB LARGE
1A41 7E1D      1076 +         DEFW GETRDY
1A43           1077           EXIT
1A43 02        1077 +         DEFB XINTC
>0000          1077 +INTP@    DEFL 0
1A44 AF        1078           XOR  A             ; SET UP WAGON
1A45 32904F    1079           LD   (WAGON),A     ; STOP WAGON
               1080  ; PUT UP PLAY FIELD:
1A48 3AA14F    1081           LD   A,(RFIELD)    ; NUMBER OF CACTII
1A4B 1E58      1082           LD   E,RCACX       ; RIGHT CAC COLUMN
1A4D 01C21D    1083           LD   BC,RFTAB      ; POSITIONS TABLE FOR CACTII
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

1A50 CD8819    1084           CALL FIELD          ; PUT THE CACTII UP
1A53 3AA54F    1085           LD   A,(LFIELD)
1A56 1E40      1086           LD   E,LCACX
1A58 01BD1D    1087           LD   BC,LFTAB
1A5B CD8819    1088           CALL FIELD
               1089  ; INITIALIZE Q POINTERS
1A5E 3E4F      1090  INITQ    LD   A,LCOWB.SHR.8
1A60 32144F    1091           LD   (WRITQ+2),A
1A63 32174F    1092           LD   (VECQ+2),A
               1093  ; SET UP VECTORS SO COWBOYS WALK OUT
1A66 DD21614F  1094           LD   IX,LCOWB       ; LEFT COWBOY VECTOR
1A6A DD360010  1095           LD   (IX+VBMR),10H
1A6E 21154F    1096           LD   HL,VECQ
1A71 CD341D    1097           CALL COWINT
1A74 DD21784F  1098           LD   IX,RCOWB       ; RIGHT COWBOY VECTOR
1A78 DD360050  1099           LD   (IX+VBMR),50H
1A7C CD341D    1100           CALL COWINT
1A7F 3A904F    1101           LD   A,(WAGON)      ; IF WAGON IS ON
1A82 B7        1102           OR   A
1A83 281D      1103           JR   Z,MIDC-$
1A85 DD218F4F  1104           LD   IX,WAGVEC      ; THEN ACTIVATE WAGON
1A89 DD360010  1105           LD   (IX+VBMR),10H
1A8D DD360C03  1106           LD   (IX+VBYCHK),3
1A91 DD360840  1107           LD   (IX+VBDYL),40H
1A95 DD360648  1108           LD   (IX+VBXH),72
1A99 DD360B0A  1109           LD   (IX+VBYH),TLINE
1A9D CD541D    1110           CALL ADDTQ
1AA0 180B      1111           JR   BORG-$
1AA2 3E08      1112  MIDC:    LD   A,8
1AA4 D319      1113           OUT  (XPAND),A
1AA6           1114           SYSSUK WRITP        ; ELSE PUT UP A CACTUS
1AA6 FF        1114 +         RST  56
1AA7 23        1114 +         DEFB WRITP+1
               1114 +         IF   WRITP.EQ.INTPC
               1114 +         ENDIF
1AA8 4C        1115           DEFB CCACX
1AA9 2A        1116           DEFB MCACY
1AAA 08        1117           DEFB 8              ; EXPAND
1AAB F81E      1118           DEFW CACTUS
               1119  ; INITIALIZE BULLET VECTORS
1AAD 111200    1120  BORG:    LD   DE,BULVSZ
1AB0 DD21184F  1121           LD   IX,BULV1
1AB4 012004    1122           LD   BC,4*256+20H
1AB7 3E02      1123           LD   A,2
1AB9 B8        1124  BULLP    CP   B
1ABA 2002      1125           JR   NZ,TIYU-$
1ABC 0E60      1126           LD   C,60H
1ABE DD7100    1127  TIYU     LD   (IX+VBMR),C
1AC1 DD360701  1128           LD   (IX+VBXCHK),1
1AC5 DD360C03  1129           LD   (IX+VBYCHK),3
1AC9 DD19      1130           ADD  IX,DE
1ACB 10EC      1131           DJNZ BULLP-$
               1132  ; FIRE UP INTERRUPTS
1ACD 3E1D      1133           LD   A,INTTBL.SHR.8
1ACF ED47      1134           LD   I,A
               1135  ;        IM   2              ;DONE IN MENU
1AD1 3E78      1136           LD   A,LFRVEC.AND.OFFH
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND      COMMENT

1AD3 D30D      1137           OUT  (INFBK),A
               1138  ; ***
               1139  ; LET COWBOYS WALK OUT
               1140  ; ***
1AD5           1141  WALK:    SYSSUK PAWS
1AD5 FF        1141 +         RST  56
1AD6 51        1141 +         DEFB PAWS+1
               1141 +         IF   PAWS.EQ.INTPC
               1141 +         ENDIF
1AD7 64        1142           DEFB 100
1AD8 F3        1143           DI
1AD9 DD210D02  1144           LD   IX,FNTSML
1ADD           1145           SYSTEM INTPC
1ADD FF        1145 +         RST  56
1ADE 00        1145 +         DEFB INTPC
               1145 +         IF   INTPC.EQ.INTPC
>0001          1145 +INTP@    DEFL 1
               1145 +         ENDIF
               1146  ; ERASE GET READY
1ADF           1147           DO   BLANK
1ADF 2B        1147 +         DEFB BLANK+1
1AE0 12        1148           DEFB 18
1AE1 08        1149           DEFB 8
1AE2 FF        1150           DEFB 0FFH
1AE3 00000000  1151           XYDEFW (GRX/4)+4000H,GRY
1AE7           1152           TEXT DRAW,DRX,GRY,LARGE
1AE7 35        1152 +         DEFB STRDIS+1
1AE8 40        1152 +         DEFB DRX
1AE9 01        1152 +         DEFB GRY
1AEA 0B        1152 +         DEFB LARGE
1AEB 8B1D      1152 +         DEFW DRAW
1AED           1153           DO   CHRDIS
1AED 33        1153 +         DEFB CHRDIS+1
1AEE 20        1154           DEFB LBULX
1AEF 02        1155           DEFB BSY
1AF0 0B        1156           DEFB BULT
1AF1 BB        1157           DEFB 0BBH         ; BULLET
1AF2           1158           DO   MCALL        ; 5 MORE
1AF2 07        1158 +         DEFB MCALL+1
1AF3 571B      1159           DEFW BULRIT
1AF5           1160           DO   SUCK
1AF5 0D        1160 +         DEFB SUCK+1
1AF6 01        1161           DEFB 00000001B
1AF7 68        1162           DEFB RBULX        ; DO THE RIGHT ONES
1AF8           1163           DONT CHRDIS       ; DISPLAY FIRST ONE
1AF8 32        1163 +         DEFB CHRDIS
1AF9           1164           DO   MCALL        ; DISP THE OTHER 5
1AF9 07        1164 +         DEFB MCALL+1
1AFA 571B      1165           DEFW BULRIT
1AFC           1166           DO   PAWS
1AFC 51        1166 +         DEFB PAWS+1
1AFD 3C        1167           DEFB 60
1AFE           1168           DO   BLANK
1AFE 2B        1168 +         DEFB BLANK+1
1AFF 08        1169           DEFB 8
1B00 08        1170           DEFB 8
1B01 FF        1171           DEFB 0FFH
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND       COMMENT

1B02 00000000 1172          XYDEFW (DRX/4)+4000H,GRY
1B06          1173          EXIT
1B06 02       1173 +        DEFB XINTC
>0000         1173 +INTP@   DEFL 0
```

```
ADDR OBJECT   STMT  LABEL    OPCD OPERAND       COMMENT

              1175  ; *****
              1176  ; MAIN LOOP DURING ROUND
              1177  ; GETS HANDLES, SETS VECTORS AND CHECKS BULLETS
1B07          1178  LOOP:    SYSTEM INTPC
1B07 FF       1178 +         RST  56
1B08 00       1178 +         DEFB INTPC
              1178 +         IF   INTPC.EQ.INTPC
>0001         1178 +INTP@    DEFL 1
              1178 +         ENDIF
1B09          1179           DO   SENTRY
1B09 43       1179 +         DEFB SENTRY+1
1B0A 1402     1180           DEFW ALKEYS
1B0C          1181           DO   DOIT
1B0C 45       1181 +         DEFB DOIT+1
1B0D 381B     1182           DEFW DTAB
1B0F          1183           EXIT
1B0F 02       1183 +         DEFB XINTC
>0000         1183 +INTP@    DEFL 0


              1185  ; CHECK FOR DEATHS
1B10 DD21184F 1186  DEATH    LD   IX,BULV1
1B14 111200   1187           LD   DE,BULVSZ
1B17 0604     1188           LD   B,4
1B19 C5       1189  LPPP2    PUSH BC
1B1A D5       1190           PUSH DE
1B1B CDCE18   1191           CALL HITCHK
1B1E D1       1192           POP  DE
1B1F C1       1193           POP  BC
1B20 DD19     1194           ADD  IX,DE
1B22 3ADE4F   1195           LD   A,(SEMI4S)    ; CHECK IF DEATH MODE
1B25 3D       1196           DEC  A
1B26 28DF     1197           JR   Z,LOOP-$
1B28 10EF     1198           DJNZ LPPP2-$
1B2A 18DB     1199           JR   LOOP-$
              1200  ;
1B2C          1201  ENDRND   EXIT
1B2C 02       1201 +         DEFB XINTC
>0000         1201 +INTP@    DEFL 0
1B2D C30C1A   1202           JP   STRND
              1203  ;
1B30 3AF84F   1204  ENDGAM:  LD   A,(GAMSTB)
1B33 CB7F     1205           BIT  GSBEND,A
1B35 C8       1206           RET  Z
1B36          1207           SYSTEM QUIT
1B36 FF       1207 +         RST  56
1B37 78       1207 +         DEFB QUIT
              1207 +         IF   QUIT.EQ.INTPC
              1207 +         ENDIF



1B38          1209  DTAB:    JMP  SCT7,ENDRND
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

1B38 08        1209 +         DEFB SCT7
1B39 2C1B      1209 +         DEFW ENDRND
               1209 +         IF   0
               1209 +         ENDIF
1B3B           1210           JMP  SF0,ENDRND
1B3B 09        1210 +         DEFB SF0
1B3C 2C1B      1210 +         DEFW ENDRND
               1210 +         IF   0
               1210 +         ENDIF
1B3E           1211           RC   SP0,PPOT0
1B3E 5C        1211 +         DEFB SP0+40H
1B3F B918      1211 +         DEFW PPOT0
               1211 +         IF   0
               1211 +         ENDIF
1B41           1212           RC   SP1,PPOT1
1B41 5D        1212 +         DEFB SP1+40H
1B42 B118      1212 +         DEFW PPOT1
               1212 +         IF   0
               1212 +         ENDIF
1B44           1213           RC   SJ0,JOY0
1B44 55        1213 +         DEFB SJ0+40H
1B45 8F18      1213 +         DEFW JOY0
               1213 +         IF   0
               1213 +         ENDIF
1B47           1214           RC   SJ1,JOY1
1B47 57        1214 +         DEFB SJ1+40H
1B48 9518      1214 +         DEFW JOY1
               1214 +         IF   0
               1214 +         ENDIF
1B4A           1215           MC   SKYD,NBRK
1B4A 93        1215 +         DEFB SKYD+80H
1B4B 8D18      1215 +         DEFW NBRK
               1215 +         IF   0
               1215 +         ENDIF
1B4D           1216           RC   ST0,FIRE0
1B4D 54        1216 +         DEFB ST0+40H
1B4E FF17      1216 +         DEFW FIRE0
               1216 +         IF   0
               1216 +         ENDIF
1B50           1217           RC   ST1,FIRE1
1B50 56        1217 +         DEFB ST1+40H
1B51 0A18      1217 +         DEFW FIRE1
               1217 +         IF   0
               1217 +         ENDIF
1B53           1218           RC   SSEC,DCLOCK,+END
1B53 51        1218 +         DEFB SSEC+40H
1B54 E117      1218 +         DEFW DCLOCK
               1218 +         IF   0+END
1B56 C0        1218 +         DEFB 0+END
               1218 +         ENDIF



1B57           1220  BULRIT   DONT CHRDIS
1B57 32        1220 +         DEFB CHRDIS
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

1B58           1221           DONT CHRDIS
1B58 32        1221 +         DEFB CHRDIS
1B59           1222           DONT CHRDIS
1B59 32        1222 +         DEFB CHRDIS
1B5A           1223           DONT CHRDIS
1B5A 32        1223 +         DEFB CHRDIS
1B5B           1224           DONT CHRDIS
1B5B 32        1224 +         DEFB CHRDIS
1B5C           1225           DONT MRET
1B5C 08        1225 +         DEFB MRET



               1227  ; ************************************
               1228  ; * GUNFIGHT WRITE INTERRUPT ROUTINE *
               1229  ; ************************************
1B5D 08        1230  GFWRIT:  EX   AF,AF'
1B5E D9        1231           EXX
1B5F DDE5      1232           PUSH IX
1B61 3E78      1233  BEGINT:  LD   A,LFRVEC.AND.0FFH ;  ESTABLISH TICKS INT
1B63 D30D      1234           OUT  (INFBK),A
1B65 3EC8      1235           LD   A,LFRLIN
1B67 D30F      1236           OUT  (INLIN),A
1B69 21124F    1237           LD   HL,WRITQ       ; GET FIRST WRITE Q ENTRY
1B6C CD6B1D    1238           CALL FIRST
1B6F CD291D    1239           CALL DELQ         ; DROP FROM WRITE Q
1B72 AF        1240           XOR  A
1B73 32FF0F    1241           LD   (WASTE),A
1B76 DDCB0146  1242           BIT  VBSWAG,(IX+VBSTAT) ; WAGON?
1B7A 2028      1243           JR   NZ,GFWRT1-$  ; JUMP IF YEP
               1244  ; GUNFIGHTER - BLANKETH HIM
1B7C 110514    1245           LD   DE,1405H       ; LOAD BLANKING PARMS
1B7F           1246           SYSTEM VBLANK     ; CALL BLANKER
1B7F FF        1246 +         RST  56
1B80 28        1246 +         DEFB VBLANK
               1246 +         IF   VBLANK.EQ.INTPC
               1246 +         ENDIF
1B81 261E      1247           LD   H,LEGO.SHR.8 ; WRITE LEG PATTERN
1B83 DD6E12    1248           LD   L,(IX+VBLEG)
1B86 2C        1249           INC  L             ; SKIP OVER LINK AND TIME
1B87 2C        1250           INC  L
1B88           1251           SYSTEM VWRITR     ; AND WRITE LEG
1B88 FF        1251 +         RST  56
1B89 1E        1251 +         DEFB VWRITR
               1251 +         IF   VWRITR.EQ.INTPC
               1251 +         ENDIF
               1252  ; IS GUNFIGHTER DEAD?
1B8A DDCB016E  1253           BIT  VBSINT,(IX+VBSTAT)
1B8E 2030      1254           JR   NZ,GFWRT5-$  ; JUMP IF SO
1B90 21DB1D    1255           LD   HL,ARMTBL     ; LOOKUP ARM PATTERN
1B93 1600      1256           LD   D,0
1B95 DD5E0F    1257           LD   E,(IX+VBARM)
1B98 19        1258           ADD  HL,DE
1B99 5E        1259           LD   E,(HL)
1B9A 23        1260           INC  HL
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND       COMMENT

1B9B 56       1261          LD   D,(HL)
1B9C EB       1262          EX   DE,HL
1B9D          1263          SYSTEM VWRITR      ; WRITE ARM PATTERN
1B9D FF       1263 +        RST  56
1B9E 1E       1263 +        DEFB VWRITR
              1263 +        IF   VWRITR.EQ.INTPC
              1263 +        ENDIF
1B9F 21101F   1264          LD   HL,GFBODY     ; LOAD BODY PATTERN
1BA2 1808     1265          JR   GFWRT2-$      ; JOIN WAGON WRITE
              1266  ; BLANK THE WAGON
1BA4 110416   1267  GFWRT1: LD   DE,1604H      ; LOAD WAGON SIZE
1BA7          1268          SYSTEM VBLANK
1BA7 FF       1268 +        RST  56
1BA8 28       1268 +        DEFB VBLANK
              1268 +        IF   VBLANK.EQ.INTPC
              1268 +        ENDIF
1BA9 21401F   1269          LD   HL,WAGPAT
1BAC          1270  GFWRT2: SYSTEM VWRITR      ; NOW WRITE
1BAC FF       1270 +        RST  56
1BAD 1E       1270 +        DEFB VWRITR
              1270 +        IF   VWRITR.EQ.INTPC
              1270 +        ENDIF
1BAE DD720E   1271  GFWRT4: LD   (IX+VBOAH),D
1BB1 DD730D   1272          LD   (IX+VBOAL),E
1BB4 21154F   1273  GFWRT3: LD   HL,VECQ       ; ADD VECTOR TO VECTOR Q
1BB7 CD541D   1274          CALL ADDTQ
1BBA DDE1     1275          POP  IX
1BBC 08       1276          EX   AF,AF'
1BBD D9       1277          EXX
1BBE FB       1278  EIRE    EI
1BBF C9       1279          RET
1BC0 210C1F   1280  GFWRT5: LD   HL,NULPAT
1BC3 18E7     1281          JR   GFWRT2-$
              1282  ; ***********************************
              1283  ; * GUNFIGHT LOW FOREGROUND ROUTINE *
              1284  ; ***********************************
1BC5 F5       1285  GFLFR:  PUSH AF
1BC6 C5       1286          PUSH BC
1BC7 D5       1287          PUSH DE
1BC8 E5       1288          PUSH HL
1BC9 DDE5     1289          PUSH IX
              1290  ; BUMP TIME BASES OF ACTIVE OR INTERCEPTED VECTORS
1BCB 21194F   1291          LD   HL,BULV1+VBSTAT
1BCE 111100   1292          LD   DE,BULVSZ-1
1BD1 0604     1293          LD   B,4
1BD3 CD1E1D   1294          CALL TBUMP
1BD6 23       1295          INC  HL            ; SKIP LINK FIELD
1BD7 111600   1296          LD   DE,GFVSIZ-1
1BDA 0603     1297          LD   B,3
1BDC CD1E1D   1298          CALL TBUMP
              1299  ; LOOP TO UNWRITE, THEN WRITE ALL 4 BULLETS
              1300  ; BUT FIRST, A WORD TO OUR SHIFTER
1BDF AF       1301          XOR  A
1BE0 32FF0F   1302          LD   (WASTE),A
1BE3 0604     1303          LD   B,4
1BE5 DD21184F 1304          LD   IX,BULV1
              1305  ; UNWRITE THIS GUY?
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND          COMMENT

1BE9 DDCB0176  1306  WRBUL1:  BIT  VBBLNK,(IX+VBSTAT)
1BED 2811      1307           JR   Z,WRBUL2-$      ; JUMP IF NOT
1BEF DD660E    1308           LD   H,(IX+VBOAH)
1BF2 DD6E0D    1309           LD   L,(IX+VBOAL)
1BF5 DD7E0F    1310           LD   A,(IX+VBARM) ; GET LAST MR
1BF8 D30C      1311           OUT  (MAGIC),A
1BFA 36C0      1312           LD   (HL),0C0H       ; UNWRITE BULLET
1BFC DDCB01B6  1313           RES  VBBLNK,(IX+VBSTAT) ; CLEAR BLANK BIT
               1314  ; SHALL WE WRITE THIS GUY?
1C00 DDCB017E  1315  WRBUL2:  BIT  VBSACT,(IX+VBSTAT)
1C04 282B      1316           JR   Z,WRBUL4-$
1C06 DD560B    1317           LD   D,(IX+VBYH)
1C09 DD5E06    1318           LD   E,(IX+VBXH)
1C0C DD7E00    1319           LD   A,(IX+VBMR)
1C0F           1320           SYSTEM RELABS
1C0F FF        1320 +         RST  56
1C10 38        1320 +         DEFB RELABS
               1320 +         IF   RELABS.EQ.INTPC
               1320 +         ENDIF
1C11 DD720E    1321           LD   (IX+VBOAH),D
1C14 DD730D    1322           LD   (IX+VBOAL),E
1C17 DD770F    1323           LD   (IX+VBARM),A
1C1A 210040    1324           LD   HL,NORMEM-SCREEN
1C1D 19        1325           ADD  HL,DE
>4FFF          1326  DIFER    EQU  WASTE-SCREEN+NORMEM
1C1E 7E        1327           LD   A,(HL)
1C1F EB        1328           EX   DE,HL
1C20 36C0      1329           LD   (HL),0C0H
1C22 B7        1330           OR   A
1C23 2808      1331           JR   Z,WRBUL3-$      ; JUMP IF NOT
1C25 DDCB01BE  1332           RES  VBSACT,(IX+VBSTAT) ; KILL ACTIVE BIT
1C29 DDCB01EE  1333           SET  VBSINT,(IX+VBSTAT) ; SET INTERCEPT BIT
1C2D DDCB01F6  1334  WRBUL3:  SET  VBBLNK,(IX+VBSTAT) ; SET BLANK BIT
               1335  ; STEP TO NEXT BULLET VECTOR, LOOP BACK IF NOT DONE
1C31 111200    1336  WRBUL4:  LD   DE,BULVSZ
1C34 DD19      1337           ADD  IX,DE
1C36 10B1      1338           DJNZ WRBUL1-$
               1339  ; GET NEXT PATTERN TO WRITE, AND SCHEDULE HIM
1C38 21124F    1340           LD   HL,WRITQ
1C3B CD6B1D    1341           CALL FIRST
1C3E 2812      1342           JR   Z,WRBL5A-$      ; JUMP IF EMPTY Q
1C40 3E7A      1343           LD   A,WRTVEC.AND.0FFH ; SET FEEDBACK REG
1C42 D30D      1344           OUT  (INFBK),A
1C44 DD7E0B    1345           LD   A,(IX+VBYH)    ; WHICH WINDOW TO USE?
1C47 FE32      1346           CP   WINBND         ; COMPARE TO WINDOW BOUNDARY
1C49 3E00      1347           LD   A,BOTLIN       ; ASSUME BOTTOM LINE
1C4B 3002      1348           JR   NC,WRBUL5-$    ; JUMP IF GOOD GUESS
1C4D 3E6A      1349           LD   A,TOPLIN       ; WRONG - USE TOP
1C4F D30F      1350  WRBUL5:  OUT  (INLIN),A      ; SET LINE REGISTER
1C51 FB        1351           EI
               1352  ; LOOP THRU VECTORING THOSE BULLETS
1C52 DD21184F  1353  WRBL5A   LD   IX,BULV1
1C56 0604      1354           LD   B,4
1C58 218F1D    1355           LD   HL,BULLMT      ; HL = BULLET LIMITS TABLE
1C5B 111200    1356           LD   DE,BULVSZ
1C5E DDCB017E  1357  WRBUL6:  BIT  VBSACT,(IX+VBSTAT) ; ACTIVE BULLET?
1C62 280C      1358           JR   Z,WRBUL7-$
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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

1C64           1359           SYSTEM VECT
1C64 FF        1359 +         RST  56
1C65 3E        1359 +         DEFB VECT
               1359 +         IF   VECT.EQ.INTPC
               1359 +         ENDIF
1C66 DDCB075E  1360           BIT  VBCLAT,(IX+VBXCHK) ; DID Y HIT EDGE?
1C6A 2804      1361           JR   Z,WRBUL7-$   ; NOPE
1C6C DDCB01BE  1362           RES  VBSACT,(IX+VBSTAT) ; DEACTIVATE BULLET
1C70 DD19      1363  WRBUL7:  ADD  IX,DE
1C72 10EA      1364           DJNZ WRBUL6-$     ; LOOP BACK
               1365  ; NOW PUT SOMETHING ON THE WRITE Q
1C74 0602      1366           LD   B,2          ; MAX 2 TIMES THRU
1C76 21154F    1367           LD   HL,VECQ
1C79 CD6B1D    1368  GVECT:   CALL FIRST        ; GET VECTOR Q ENTRY
1C7C CAFC1C    1369           JP   Z,GVECT4     ; JUMP IF Q EMPTY
1C7F CD291D    1370           CALL DELQ         ; DROP FROM VECTOR Q
1C82 FB        1371           EI
               1372  ; WAGON?
1C83 DDCB0146  1373           BIT  VBSWAG,(IX+VBSTAT)
1C87 C2071D    1374           JP   NZ,GVECT5    ; JUMP ON WAGON
               1375  ; DEAD?
1C8A DDCB016E  1376           BIT  VBSINT,(IX+VBSTAT)
1C8E 2025      1377           JR   NZ,GVECT1-$  ; JUMP IF DEAD
               1378  ; ZERO VELOCITY?
1C90 DD7E03    1379           LD   A,(IX+VBDXL)
1C93 DDB604    1380           OR   (IX+VBDXH)
1C96 DDB608    1381           OR   (IX+VBDYL)
1C99 DDB609    1382           OR   (IX+VBDYH)
1C9C 2017      1383           JR   NZ,GVECT1-$  ; GVECT1 IF NONZERO
1C9E DD7702    1384           LD   (IX+VBTIMB),A ; ZERO TIME BASE
1CA1 DDCB0166  1385           BIT  VBSNOM,(IX+VBSTAT) ; ALREADY STATIONARY?
1CA5 2036      1386           JR   NZ,GVEC3A-$
               1387  ; SET STATIONARY LEGS
1CA7 DD36124F  1388           LD   (IX+VBLEG),LEGO.AND.OFFH
1CAB DDCB01DE  1389           SET  VBSCHG,(IX+VBSTAT) ; SET CHANGED
1CAF DDCB01E6  1390           SET  VBSNOM,(IX+VBSTAT) ;AND STATIONARY
1CB3 1828      1391           JR   GVEC3A-$     ; JUMP TO ARM CHECK
               1392  ; MOVING GUNFIGHTER
               1393  ; VECTOR
1CB5 21871D    1394  GVECT1:  LD   HL,GUNLMT    ; LOAD GF LIMITS
1CB8           1395           SYSTEM VECT
1CB8 FF        1395 +         RST  56
1CB9 3E        1395 +         DEFB VECT
               1395 +         IF   VECT.EQ.INTPC
               1395 +         ENDIF
1CBA 2808      1396           JR   Z,GVECT2-$   ; JUMP IF HE DIDN'T MOVE
1CBC DDCB01DE  1397           SET  VBSCHG,(IX+VBSTAT) ; SET CHANGED BIT
1CC0 DDCB01A6  1398           RES  VBSNOM,(IX+VBSTAT) ; CLEAR NOT MOVING STATUS
               1399  ; NEED WE GO TO NEXT CELL IN ANIMATION SEQUENCE?
1CC4 DD7E11    1400  GVECT2:  LD   A,(IX+VBLEGT) ; A = ANIMATION TIMER
1CC7 91        1401           SUB  C            ; SUBTRACT TIME BASE
1CC8 F2DA1C    1402           JP   P,GVECT3     ; JUMP IF NOT COUNTED DOWN
               1403  ; GET NEXT CELL
1CCB DD5E12    1404           LD   E,(IX+VBLEG) ; GET LINK
1CCE 161E      1405           LD   D,LEGO.SHR.8 ; SET H.O. PART
1CD0 1A        1406           LD   A,(DE)       ; A = NEXT
1CD1 DD7712    1407           LD   (IX+VBLEG),A
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

1CD4 13        1408           INC  DE             ; STEP TO TIMER
1CD5 1A        1409           LD   A,(DE)         ; GET NEW TIMER
1CD6 DDCB01DE  1410           SET  VBSCHG,(IX+VBSTAT) ; SET CHANGED BIT
1CDA DD7711    1411  GVECT3:  LD   (IX+VBLEGT),A ; STORE BACK TIMER
               1412  ; DID ARM CHANGE?
1CDD DD7E0F    1413  GVEC3A:  LD   A,(IX+VBARM)
1CE0 DDBE10    1414           CP   (IX+VBOARM)    ; COMPARE TO OLD ARM
1CE3 2807      1415           JR   Z,GVEC3B-$     ; JUMP IF NO CHANGE
1CE5 DDCB01DE  1416           SET  VBSCHG,(IX+VBSTAT) ; SET CHANGED BIT
1CE9 DD7710    1417           LD   (IX+VBOARM),A
               1418  ; ADD ITEM TO WRITE Q?
1CEC DDCB015E  1419  GVEC3B:  BIT  VBSCHG,(IX+VBSTAT)
1CF0 2020      1420           JR   NZ,GVECT6-$    ; YES GVECT6
               1421  ; NO CHANGE - LINK TO VECTOR Q
1CF2 21154F    1422           LD   HL,VECQ
1CF5 CD541D    1423           CALL ADDTQ
1CF8 05        1424           DEC  B
1CF9 C2791C    1425           JP   NZ,GVECT       ; SUB FOR DJNZ
1CFC FB        1426  GVECT4:  EI
1CFD CD0002    1427           CALL STIMER
1D00 DDE1      1428           POP  IX
1D02 E1        1429           POP  HL
1D03 D1        1430           POP  DE
1D04 C1        1431           POP  BC
1D05 F1        1432           POP  AF
1D06 C9        1433           RET
               1434  ; VECTOR AND Q WAGON
1D07 217C1D    1435  GVECT5:  LD   HL,WAGLMT
1D0A           1436           SYSTEM VECT
1D0A FF        1436 +         RST  56
1D0B 3E        1436 +         DEFB VECT
               1436 +         IF   VECT.EQ.INTPC
               1436 +         ENDIF
1D0C 21154F    1437           LD   HL,VECQ
1D0F CD291D    1438           CALL DELQ           ; REMOVE FROM VECTOR Q
1D12 DDCB019E  1439  GVECT6:  RES  VBSCHG,(IX+VBSTAT)
1D16 21124F    1440           LD   HL,WRITQ
1D19 CD541D    1441           CALL ADDTQ
1D1C 18DE      1442           JR   GVECT4-$       ; JUMP BACK TO QUIT
               1443  ; ROUTINE TO BUMP TIME BASES OF VECTORS
1D1E 7E        1444  TBUMP:   LD   A,(HL)         ; GET STATUS
1D1F 23        1445           INC  HL
1D20 E6A0      1446           AND  0A0H           ; ACTIVE OR INTERCEPTED?
1D22 2801      1447           JR   Z,TBUMP1-$     ; NO - TBUMP1
1D24 34        1448           INC  (HL)           ; BUMP THE TIME BASE
1D25 19        1449  TBUMP1:  ADD  HL,DE
1D26 10F6      1450           DJNZ TBUMP-$
1D28 C9        1451           RET
               1452  ; SUBROUTINE TO DELETE ENTRY AT FRONT OF Q
               1453  ; ENTRY:          HL = HEAD-TAIL, IX = OBJECT, A = CLOBBERE
1D29 F3        1454  DELQ:    DI
1D2A DD7EFF    1455           LD   A,(IX+NEXT)    ; HEAD = NEXT(OBJECT)
1D2D 77        1456           LD   (HL),A
1D2E A7        1457           AND  A              ; IS HEAD NOW NIL?
1D2F C0        1458           RET  NZ             ; QUIT IF NOT
1D30 23        1459           INC  HL             ; YES - SET TAIL = NIL TOO
1D31 77        1460           LD   (HL),A
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

1D32 2B        1461           DEC  HL
1D33 C9        1462           RET
1D34 DD360332  1463  COWINT   LD   (IX+VBDXL),50 ;  SLOW WALK OUT
1D38 DD360180  1464           LD   (IX+VBSTAT),80H ;  ACTIVATE
1D3C DD360701  1465           LD   (IX+VBXCHK),1
1D40 DD360C01  1466           LD   (IX+VBYCHK),1
1D44 DD360604  1467           LD   (IX+VBXH),4
1D48 DD360B28  1468           LD   (IX+VBYH),40
1D4C DD360F06  1469           LD   (IX+VBARM),6 ;  SET ARM STRAIGHT
1D50 DD36124F  1470           LD   (IX+VBLEG),LEGO.AND.OFFH
               1471  ;        JP      ADDTQ
               1472  ; SUBROUTINE TO APPEND ENTRY TO END OF Q
               1473  ; ENTRY:          HL = HEAD-TAIL BYTES, IX = OBJECT, A,DE C
1D54 DDE5      1474  ADDTQ:   PUSH IX              ; DE = ENTRY
1D56 D1        1475           POP  DE
1D57 F3        1476           DI
1D58 DD36FF00  1477           LD   (IX+NEXT),0    ; NEXT(OBJ)=NIL
1D5C 23        1478           INC  HL
1D5D 7E        1479           LD   A,(HL)         ; A = OLD TAIL
1D5E 73        1480           LD   (HL),E         ; SET TAIL = .OBJ
1D5F A7        1481           AND  A              ; WAS OLD TAIL NIL?
1D60 2806      1482           JR   Z,ADDTQ1-$     ; JUMP IF SO
               1483  ; NONNIL OLD TAIL, SET NEXT(OLDTAIL)=.OBJ
1D62 5F        1484           LD   E,A            ; DE = .NEXT(OLDTAIL)
1D63 7E        1485           LD   A,(HL)         ; A = .OBJ (FROM NEW TAIL)
1D64 2B        1486           DEC  HL
1D65 1B        1487           DEC  DE
1D66 12        1488           LD   (DE),A
1D67 C9        1489           RET
               1490  ; NIL OLD TAIL CASE
1D68 2B        1491  ADDTQ1:  DEC  HL             ; BACKUP TO HEAD
1D69 73        1492           LD   (HL),E         ; HEAD = .OBJ
1D6A C9        1493           RET
               1494  ; SUBROUTINE TO POINT IX AT FIRST ENTRY ON A Q
               1495  ; ENTRY:          HL = Q HEAD-TAIL
               1496  ; EXIT:           IX,DE = OBJECT, A = L.O. BYTE OF OBJECT
               1497  ;                 NONZERO STATUS SET IF Q NOT EMPTY
1D6B F3        1498  FIRST:   DI
1D6C 5E        1499           LD   E,(HL)
1D6D 23        1500           INC  HL
1D6E 23        1501           INC  HL
1D6F 56        1502           LD   D,(HL)         ; D = H.O. ADDR. BYTE
1D70 2B        1503           DEC  HL
1D71 2B        1504           DEC  HL
1D72 7B        1505           LD   A,E            ; E = HEAD OF Q
1D73 A7        1506           AND  A
1D74 D5        1507           PUSH DE
1D75 DDE1      1508           POP  IX
1D77 C9        1509           RET



               1511  ; ***********************
               1512  ; * GUNFIGHT CONSTANTS *
               1513  ; ***********************
```

```
ADDR OBJECT    STMT  LABEL   OPCD OPERAND      COMMENT

               1514          ORG  ($+1).AND.OFFFEH
1D78           1515  INTTBL:
1D78 C51B      1516  LFRVEC: DEFW GFLFR
1D7A 5D1B      1517  WRTVEC: DEFW GFWRIT
               1518  ; WAGON LIMITS TABLE
1D7C 0A        1519  WAGLMT: DEFB TLINE
1D7D 44        1520          DEFB BLINE-24
1D7E 47455420  1521  GETRDY: DEFM 'GET READY'
               1522  ; GUNFIGHTER LIMITS
1D87 00        1523  GUNLMT: DEFB 0
1D88 2F        1524          DEFB LCACX-17
1D89 0A        1525          DEFB TLINE
1D8A 48        1526          DEFB BLINE-20
1D8B 44524157  1527  DRAW:   DEFM 'DRAW'
               1528  ; BULLET LIMITS
1D8F 00        1529  BULLMT  DEFB 0
1D90 9F        1530          DEFB 159
1D91 09        1531          DEFB ALINE
1D92 5B        1532          DEFB BLINE-1
               1533  BN      MACR #DX,#ARMX,#DY,#ARMY
               1534          DEFW #DX
               1535          DEFB #ARMX
               1536          DEFW #DY
               1537          DEFB #ARMY
               1538          ENDM
1D93           1539  BULTAB  BN   768,15,768,15
1D93 0003      1539 +        DEFW 768
1D95 0F        1539 +        DEFB 15
1D96 0003      1539 +        DEFW 768
1D98 0F        1539 +        DEFB 15
1D99           1540          BN   1024,15,512,12
1D99 0004      1540 +        DEFW 1024
1D9B 0F        1540 +        DEFB 15
1D9C 0002      1540 +        DEFW 512
1D9E 0C        1540 +        DEFB 12
1D9F           1541          BN   1024,15,256,11
1D9F 0004      1541 +        DEFW 1024
1DA1 0F        1541 +        DEFB 15
1DA2 0001      1541 +        DEFW 256
1DA4 0B        1541 +        DEFB 11
1DA5           1542          BN   1024,15,0,8
1DA5 0004      1542 +        DEFW 1024
1DA7 0F        1542 +        DEFB 15
1DA8 0000      1542 +        DEFW 0
1DAA 08        1542 +        DEFB 8
1DAB           1543          BN   1024,15,-256,6
1DAB 0004      1543 +        DEFW 1024
1DAD 0F        1543 +        DEFB 15
1DAE 00FF      1543 +        DEFW -256
1DB0 06        1543 +        DEFB 6
1DB1           1544          BN   1024,15,-512,4
1DB1 0004      1544 +        DEFW 1024
1DB3 0F        1544 +        DEFB 15
1DB4 00FE      1544 +        DEFW -512
1DB6 04        1544 +        DEFB 4
1DB7           1545          BN   768,15,-768,3
1DB7 0003      1545 +        DEFW 768
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND      COMMENT

1DB9 0F        1545 +         DEFB 15
1DBA 00FD      1545 +         DEFW -768
1DBC 03        1545 +         DEFB 3
1DBD           1546  LFTAB:   DEF5 72,22,44,67,14
1DBD 48        1546 +         DEFB 72
1DBE 16        1546 +         DEFB 22
1DBF 2C        1546 +         DEFB 44
1DC0 43        1546 +         DEFB 67
1DC1 0E        1546 +         DEFB 14
1DC2           1547  RFTAB:   DEF5 18,68,40,13,63
1DC2 12        1547 +         DEFB 18
1DC3 44        1547 +         DEFB 68
1DC4 28        1547 +         DEFB 40
1DC5 0D        1547 +         DEFB 13
1DC6 3F        1547 +         DEFB 63
1DC7 9D        1548  GFCOLS:  DEFB 9DH
1DC8 76        1549           DEFB 76H
1DC9 FC        1550           DEFB 0FCH
1DCA 87        1551           DEFB 87H
1DCB 9D        1552           DEFB 9DH
1DCC 76        1553           DEFB 76H
1DCD 6C        1554           DEFB 6CH
1DCE 87        1555           DEFB 87H
1DCF           1556  SINIT:   DEF8 6,6,0,0,0,30H,30H,0
1DCF 06        1556 +         DEFB 6
1DD0 06        1556 +         DEFB 6
1DD1 00        1556 +         DEFB 0
1DD2 00        1556 +         DEFB 0
1DD3 00        1556 +         DEFB 0
1DD4 30        1556 +         DEFB 30H
1DD5 30        1556 +         DEFB 30H
1DD6 00        1556 +         DEFB 0
1DD7           1557           DEF4 0,80H,0FH,0FH
1DD7 00        1557 +         DEFB 0
1DD8 80        1557 +         DEFB 80H
1DD9 0F        1557 +         DEFB 0FH
1DDA 0F        1557 +         DEFB 0FH
>0007          1558  NUMB:    EQU  00000111B    ; COLOR MASK
>000B          1559  BULT     EQU  00001011B
>000B          1560  TIME     EQU  00001011B
>000B          1561  LARGE:   EQU  00001011B
>000C          1562  LARG2    EQU  00001100B


               1564  ; **********************
               1565  ; * GUN FIGHT PATTERNS *
               1566  ; **********************
               1567  ;
               1568  ; PATTERN TABLES:
1DDB FC1D      1569  ARMTBL:  DEFW ARM0
1DDD 0A1E      1570           DEFW ARM1
1DDF 141E      1571           DEFW ARM2
1DE1 1C1E      1572           DEFW ARM3
1DE3 281E      1573           DEFW ARM4
1DE5 361E      1574           DEFW ARM5
1DE7 461E      1575           DEFW ARM6
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND      COMMENT

              1576  ; PATTERN DEFINITION MACROS
              1577  DEF02   MACR #A,#B
              1578          DEFB O#AH
              1579          DEFB O#BH
              1580          ENDM
              1581  DEF03   MACR #A,#B,#C
              1582          DEFB O#AH
              1583          DEFB O#BH
              1584          DEFB O#CH
              1585          ENDM
              1586  DEF04   MACR #A,#B,#C,#D
              1587          DEFB O#AH
              1588          DEFB O#BH
              1589          DEFB O#CH
              1590          DEFB O#DH
              1591          ENDM
1DE9          1592  TREE    DEF2 1,17
1DE9 01       1592 +        DEFB 1
1DEA 11       1592 +        DEFB 17
1DEB 08       1593          DEFB 00001000B
1DEC 1C       1594          DEFB 00011100B
1DED 3E       1595          DEFB 00111110B
1DEE 6B       1596          DEFB 01101011B
1DEF 08       1597          DEFB 00001000B
1DF0 08       1598          DEFB 00001000B
1DF1 3C       1599          DEFB 00111100B
1DF2 7E       1600          DEFB 01111110B
1DF3 A9       1601          DEFB 10101001B
1DF4 08       1602          DEFB 00001000B
1DF5 3C       1603          DEFB 00111100B
1DF6 7E       1604          DEFB 01111110B
1DF7 EB       1605          DEFB 11101011B
1DF8 89       1606          DEFB 10001001B
1DF9 08       1607          DEFB 00001000B
1DFA 1C       1608          DEFB 00011100B
1DFB AE       1609          DEFB 10101110B
1DFC          1610  ARMO:   DEF04 0A,0A,2,5
1DFC 0A       1610 +        DEFB 00AH
1DFD 0A       1610 +        DEFB 00AH
1DFE 02       1610 +        DEFB 02H
1DFF 05       1610 +        DEFB 05H
1E00          1611          DEF02 40,00,
1E00 40       1611 +        DEFB 040H
1E01 00       1611 +        DEFB 000H
1E02          1612          DEF02 51,00,
1E02 51       1612 +        DEFB 051H
1E03 00       1612 +        DEFB 000H
1E04          1613          DEF02 04,00,
1E04 04       1613 +        DEFB 004H
1E05 00       1613 +        DEFB 000H
1E06          1614          DEF02 01,00,
1E06 01       1614 +        DEFB 001H
1E07 00       1614 +        DEFB 000H
1E08          1615          DEF02 00,40,
1E08 00       1615 +        DEFB 000H
1E09 40       1615 +        DEFB 040H
1E0A          1616  ARM1:   DEF04 0A,0A,2,3
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND        COMMENT

1E0A 0A        1616 +         DEFB 00AH
1E0B 0A        1616 +         DEFB 00AH
1E0C 02        1616 +         DEFB 02H
1E0D 03        1616 +         DEFB 03H
1E0E           1617           DEF02 50,00,
1E0E 50        1617 +         DEFB 050H
1E0F 00        1617 +         DEFB 000H
1E10           1618           DEF02 14,00,
1E10 14        1618 +         DEFB 014H
1E11 00        1618 +         DEFB 000H
1E12           1619           DEF02 01,40,
1E12 01        1619 +         DEFB 001H
1E13 40        1619 +         DEFB 040H
1E14           1620  ARM2:    DEF04 0A,0A,2,2
1E14 0A        1620 +         DEFB 00AH
1E15 0A        1620 +         DEFB 00AH
1E16 02        1620 +         DEFB 02H
1E17 02        1620 +         DEFB 02H
1E18           1621           DEF02 54,00,
1E18 54        1621 +         DEFB 054H
1E19 00        1621 +         DEFB 000H
1E1A           1622           DEF02 55,40,
1E1A 55        1622 +         DEFB 055H
1E1B 40        1622 +         DEFB 040H
1E1C           1623  ARM3:    DEF04 0A,7,2,4
1E1C 0A        1623 +         DEFB 00AH
1E1D 07        1623 +         DEFB 07H
1E1E 02        1623 +         DEFB 02H
1E1F 04        1623 +         DEFB 04H
1E20           1624           DEF02 10,00,
1E20 10        1624 +         DEFB 010H
1E21 00        1624 +         DEFB 000H
1E22           1625           DEF02 05,40,
1E22 05        1625 +         DEFB 005H
1E23 40        1625 +         DEFB 040H
1E24           1626           DEF02 54,00,
1E24 54        1626 +         DEFB 054H
1E25 00        1626 +         DEFB 000H
1E26           1627           DEF02 50,00,
1E26 50        1627 +         DEFB 050H
1E27 00        1627 +         DEFB 000H
1E28           1628  ARM4:    DEF04 0A,6,2,5
1E28 0A        1628 +         DEFB 00AH
1E29 06        1628 +         DEFB 06H
1E2A 02        1628 +         DEFB 02H
1E2B 05        1628 +         DEFB 05H
1E2C           1629           DEF02 00,40,
1E2C 00        1629 +         DEFB 000H
1E2D 40        1629 +         DEFB 040H
1E2E           1630           DEF02 45,00,
1E2E 45        1630 +         DEFB 045H
1E2F 00        1630 +         DEFB 000H
1E30           1631           DEF02 10,00,
1E30 10        1631 +         DEFB 010H
1E31 00        1631 +         DEFB 000H
1E32           1632           DEF02 50,00,
1E32 50        1632 +         DEFB 050H
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ADDR OBJECT   STMT  LABEL    OPCD OPERAND       COMMENT

1E33 00       1632 +         DEFB 000H
1E34          1633           DEF02 40,00,
1E34 40       1633 +         DEFB 040H
1E35 00       1633 +         DEFB 000H
1E36          1634  ARM5:    DEF04 0A,5,2,6
1E36 0A       1634 +         DEFB 00AH
1E37 05       1634 +         DEFB 05H
1E38 02       1634 +         DEFB 02H
1E39 06       1634 +         DEFB 06H
1E3A          1635           DEF02 00,40,
1E3A 00       1635 +         DEFB 000H
1E3B 40       1635 +         DEFB 040H
1E3C          1636           DEF02 01,00,
1E3C 01       1636 +         DEFB 001H
1E3D 00       1636 +         DEFB 000H
1E3E          1637           DEF02 05,00,
1E3E 05       1637 +         DEFB 005H
1E3F 00       1637 +         DEFB 000H
1E40          1638           DEF02 14,00,
1E40 14       1638 +         DEFB 014H
1E41 00       1638 +         DEFB 000H
1E42          1639           DEF02 54,00,
1E42 54       1639 +         DEFB 054H
1E43 00       1639 +         DEFB 000H
1E44          1640           DEF02 50,00,
1E44 50       1640 +         DEFB 050H
1E45 00       1640 +         DEFB 000H
1E46          1641  ARM6:    DEF04 0A,5,1,5
1E46 0A       1641 +         DEFB 00AH
1E47 05       1641 +         DEFB 05H
1E48 01       1641 +         DEFB 01H
1E49 05       1641 +         DEFB 05H
1E4A 01       1642           DEFB 01H
1E4B 44       1643           DEFB 44H
1E4C 10       1644           DEFB 10H
1E4D 40       1645           DEFB 40H
1E4E 40       1646           DEFB 40H
              1647  ; **** NOTE ****
              1648  ; THE FOLLOWING PATTERNS ARE CONSTRAINED TO EXIST ON THE
              1649  ; PAGE.  THE FOLLOWING 'ORG' WILL DO IT FOR EXPERIMENTAL
              1650  ; PATTERNS ARE: LEG0,LEG1,LEG2,KIL1,KIL2
              1651  ;        ORG      ($+255).AND.0FF00H        ;
1E4F 64       1652  LEG0:    DEFB LEG1.AND.0FFH
1E50 04       1653           DEFB 4
1E51          1654           DEF04 0,0F,3,5
1E51 00       1654 +         DEFB 00H
1E52 0F       1654 +         DEFB 00FH
1E53 03       1654 +         DEFB 03H
1E54 05       1654 +         DEFB 05H
1E55          1655           DEF03 01,55,00,
1E55 01       1655 +         DEFB 001H
1E56 55       1655 +         DEFB 055H
1E57 00       1655 +         DEFB 000H
1E58          1656           DEF03 05,45,40,
1E58 05       1656 +         DEFB 005H
1E59 45       1656 +         DEFB 045H
1E5A 40       1656 +         DEFB 040H
```

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ADDR OBJECT   STMT  LABEL    OPCD OPERAND       COMMENT

1E5B          1657           DEF03 15,01,40,
1E5B 15       1657 +         DEFB 015H
1E5C 01       1657 +         DEFB 001H
1E5D 40       1657 +         DEFB 040H
1E5E          1658           DEF03 50,01,40,
1E5E 50       1658 +         DEFB 050H
1E5F 01       1658 +         DEFB 001H
1E60 40       1658 +         DEFB 040H
1E61          1659           DEF03 15,00,54,
1E61 15       1659 +         DEFB 015H
1E62 00       1659 +         DEFB 000H
1E63 54       1659 +         DEFB 054H
1E64 74       1660  LEG1:    DEFB LEG2.AND.0FFH
1E65 04       1661           DEFB 4
1E66          1662           DEF04 2,0F,2,5
1E66 02       1662 +         DEFB 02H
1E67 0F       1662 +         DEFB 00FH
1E68 02       1662 +         DEFB 02H
1E69 05       1662 +         DEFB 05H
1E6A          1663           DEF02 15,50,
1E6A 15       1663 +         DEFB 015H
1E6B 50       1663 +         DEFB 050H
1E6C          1664           DEF02 54,50,
1E6C 54       1664 +         DEFB 054H
1E6D 50       1664 +         DEFB 050H
1E6E          1665           DEF02 50,50,
1E6E 50       1665 +         DEFB 050H
1E6F 50       1665 +         DEFB 050H
1E70          1666           DEF02 50,50,
1E70 50       1666 +         DEFB 050H
1E71 50       1666 +         DEFB 050H
1E72          1667           DEF02 55,15,
1E72 55       1667 +         DEFB 055H
1E73 15       1667 +         DEFB 015H
1E74 4F       1668  LEG2:    DEFB LEG0.AND.0FFH
1E75 04       1669           DEFB 4
1E76          1670           DEF04 3,0F,2,5
1E76 03       1670 +         DEFB 03H
1E77 0F       1670 +         DEFB 00FH
1E78 02       1670 +         DEFB 02H
1E79 05       1670 +         DEFB 05H
1E7A          1671           DEF02 55,00,
1E7A 55       1671 +         DEFB 055H
1E7B 00       1671 +         DEFB 000H
1E7C          1672           DEF02 15,00,
1E7C 15       1672 +         DEFB 015H
1E7D 00       1672 +         DEFB 000H
1E7E          1673           DEF02 15,00,
1E7E 15       1673 +         DEFB 015H
1E7F 00       1673 +         DEFB 000H
1E80          1674           DEF02 14,00,
1E80 14       1674 +         DEFB 014H
1E81 00       1674 +         DEFB 000H
1E82          1675           DEF02 05,40,
1E82 05       1675 +         DEFB 005H
1E83 40       1675 +         DEFB 040H
1E84 D6       1676  KIL1:    DEFB KIL2.AND.0FFH
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND       COMMENT

1E85 14        1677          DEFB 20
1E86           1678          DEF04  0, 1, 4, 13
1E86 00        1678 +        DEFB  00H
1E87 01        1678 +        DEFB  01H
1E88 04        1678 +        DEFB  04H
1E89 13        1678 +        DEFB  013H
1E8A           1679          DEF04  01, 10, 00, 00,
1E8A 01        1679 +        DEFB  001H
1E8B 10        1679 +        DEFB  010H
1E8C 00        1679 +        DEFB  000H
1E8D 00        1679 +        DEFB  000H
1E8E           1680          DEF04  45, 54, 40, 00,
1E8E 45        1680 +        DEFB  045H
1E8F 54        1680 +        DEFB  054H
1E90 40        1680 +        DEFB  040H
1E91 00        1680 +        DEFB  000H
1E92           1681          DEF04  55, 55, 40, 00,
1E92 55        1681 +        DEFB  055H
1E93 55        1681 +        DEFB  055H
1E94 40        1681 +        DEFB  040H
1E95 00        1681 +        DEFB  000H
1E96           1682          DEF04  0A, A8, 00, 00,
1E96 0A        1682 +        DEFB  00AH
1E97 A8        1682 +        DEFB  0A8H
1E98 00        1682 +        DEFB  000H
1E99 00        1682 +        DEFB  000H
1E9A           1683          DEF04  0A, A2, 00, 01,
1E9A 0A        1683 +        DEFB  00AH
1E9B A2        1683 +        DEFB  0A2H
1E9C 00        1683 +        DEFB  000H
1E9D 01        1683 +        DEFB  001H
1E9E           1684          DEF04  0A, AA, 80, 14,
1E9E 0A        1684 +        DEFB  00AH
1E9F AA        1684 +        DEFB  0AAH
1EA0 80        1684 +        DEFB  080H
1EA1 14        1684 +        DEFB  014H
1EA2           1685          DEF04  02, AA, 00, 50,
1EA2 02        1685 +        DEFB  002H
1EA3 AA        1685 +        DEFB  0AAH
1EA4 00        1685 +        DEFB  000H
1EA5 50        1685 +        DEFB  050H
1EA6           1686          DEF04  00, A8, 05, 40,
1EA6 00        1686 +        DEFB  000H
1EA7 A8        1686 +        DEFB  0A8H
1EA8 05        1686 +        DEFB  005H
1EA9 40        1686 +        DEFB  040H
1EAA           1687          DEF04  05, 55, 54, 00,
1EAA 05        1687 +        DEFB  005H
1EAB 55        1687 +        DEFB  055H
1EAC 54        1687 +        DEFB  054H
1EAD 00        1687 +        DEFB  000H
1EAE           1688          DEF04  15, 55, 50, 00,
1EAE 15        1688 +        DEFB  015H
1EAF 55        1688 +        DEFB  055H
1EB0 50        1688 +        DEFB  050H
1EB1 00        1688 +        DEFB  000H
1EB2           1689          DEF04  54, 55, 50, 00,
```

```
ADDR OBJECT   STMT  LABEL   OPCD OPERAND       COMMENT

1EB2 54       1689 +        DEFB 054H
1EB3 55       1689 +        DEFB 055H
1EB4 50       1689 +        DEFB 050H
1EB5 00       1689 +        DEFB 000H
1EB6          1690          DEF04 50,05,54,00,
1EB6 50       1690 +        DEFB 050H
1EB7 05       1690 +        DEFB 005H
1EB8 54       1690 +        DEFB 054H
1EB9 00       1690 +        DEFB 000H
1EBA          1691          DEF04 50,01,55,00,
1EBA 50       1691 +        DEFB 050H
1EBB 01       1691 +        DEFB 001H
1EBC 55       1691 +        DEFB 055H
1EBD 00       1691 +        DEFB 000H
1EBE          1692          DEF04 10,01,55,40,
1EBE 10       1692 +        DEFB 010H
1EBF 01       1692 +        DEFB 001H
1EC0 55       1692 +        DEFB 055H
1EC1 40       1692 +        DEFB 040H
1EC2          1693          DEF04 10,00,05,50,
1EC2 10       1693 +        DEFB 010H
1EC3 00       1693 +        DEFB 000H
1EC4 05       1693 +        DEFB 005H
1EC5 50       1693 +        DEFB 050H
1EC6          1694          DEF04 00,00,01,50,
1EC6 00       1694 +        DEFB 000H
1EC7 00       1694 +        DEFB 000H
1EC8 01       1694 +        DEFB 001H
1EC9 50       1694 +        DEFB 050H
1ECA          1695          DEF04 00,00,00,40,
1ECA 00       1695 +        DEFB 000H
1ECB 00       1695 +        DEFB 000H
1ECC 00       1695 +        DEFB 000H
1ECD 40       1695 +        DEFB 040H
1ECE          1696          DEF04 00,00,01,40,
1ECE 00       1696 +        DEFB 000H
1ECF 00       1696 +        DEFB 000H
1ED0 01       1696 +        DEFB 001H
1ED1 40       1696 +        DEFB 040H
1ED2          1697          DEF04 00,00,00,54,
1ED2 00       1697 +        DEFB 000H
1ED3 00       1697 +        DEFB 000H
1ED4 00       1697 +        DEFB 000H
1ED5 54       1697 +        DEFB 054H
1ED6 D6       1698  KIL2:   DEFB KIL2.AND.0FFH
1ED7 3C       1699          DEFB 60
1ED8          1700          DEF04 0,D,4,7
1ED8 00       1700 +        DEFB 00H
1ED9 0D       1700 +        DEFB 0DH
1EDA 04       1700 +        DEFB 04H
1EDB 07       1700 +        DEFB 07H
1EDC          1701          DEF04 01,10,00,00,
1EDC 01       1701 +        DEFB 001H
1EDD 10       1701 +        DEFB 010H
1EDE 00       1701 +        DEFB 000H
1EDF 00       1701 +        DEFB 000H
1EE0          1702          DEF04 45,54,40,00,
```

```
ADDR OBJECT    STMT  LABEL   OPCD OPERAND      COMMENT

1EE0 45        1702 +        DEFB 045H
1EE1 54        1702 +        DEFB 054H
1EE2 40        1702 +        DEFB 040H
1EE3 00        1702 +        DEFB 000H
1EE4           1703          DEF04 55,55,40,00,
1EE4 55        1703 +        DEFB 055H
1EE5 55        1703 +        DEFB 055H
1EE6 40        1703 +        DEFB 040H
1EE7 00        1703 +        DEFB 000H
1EE8           1704          DEF04 0A,A8,00,00,
1EE8 0A        1704 +        DEFB 00AH
1EE9 A8        1704 +        DEFB 0A8H
1EEA 00        1704 +        DEFB 000H
1EEB 00        1704 +        DEFB 000H
1EEC           1705          DEF04 0A,88,15,01,
1EEC 0A        1705 +        DEFB 00AH
1EED 88        1705 +        DEFB 088H
1EEE 15        1705 +        DEFB 015H
1EEF 01        1705 +        DEFB 001H
1EF0           1706          DEF04 16,A5,55,41,
1EF0 16        1706 +        DEFB 016H
1EF1 A5        1706 +        DEFB 0A5H
1EF2 55        1706 +        DEFB 055H
1EF3 41        1706 +        DEFB 041H
1EF4           1707          DEF04 15,55,55,55,
1EF4 15        1707 +        DEFB 015H
1EF5 55        1707 +        DEFB 055H
1EF6 55        1707 +        DEFB 055H
1EF7 55        1707 +        DEFB 055H
1EF8           1708  CACTUS  DEF2 1,12
1EF8 01        1708 +        DEFB 1
1EF9 0C        1708 +        DEFB 12
1EFA 20        1709          DEFB 00100000B
1EFB 30        1710          DEFB 00110000B
1EFC 38        1711          DEFB 00111000B
1EFD 30        1712          DEFB 00110000B
1EFE B2        1713          DEFB 10110010B
1EFF F2        1714          DEFB 11110010B
1F00 F6        1715          DEFB 11110110B
1F01 3C        1716          DEFB 00111100B
1F02 3C        1717          DEFB 00111100B
1F03 30        1718          DEFB 00110000B
1F04 30        1719          DEFB 00110000B
1F05 30        1720          DEFB 00110000B
1F06 474F5420  1721  GOTME:  DEFM 'GOT ME'
1F0C 00        1722  NULPAT: DEFB 0
1F0D 00        1723          DEFB 0
1F0E 01        1724          DEFB 1
1F0F 01        1725          DEFB 1
1F10           1726  GFBODY: DEF04 0,0,3,F
1F10 00        1726 +        DEFB 00H
1F11 00        1726 +        DEFB 00H
1F12 03        1726 +        DEFB 03H
1F13 0F        1726 +        DEFB 0FH
1F14           1727          DEF03 00,44,00,
1F14 00        1727 +        DEFB 000H
1F15 44        1727 +        DEFB 044H
```

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ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

1F16 00        1727 +         DEFB 000H
1F17           1728           DEF03 11,55,10,
1F17 11        1728 +         DEFB 011H
1F18 55        1728 +         DEFB 055H
1F19 10        1728 +         DEFB 010H
1F1A           1729           DEF03 15,55,50,
1F1A 15        1729 +         DEFB 015H
1F1B 55        1729 +         DEFB 055H
1F1C 50        1729 +         DEFB 050H
1F1D           1730           DEF03 02,AA,00,
1F1D 02        1730 +         DEFB 002H
1F1E AA        1730 +         DEFB 0AAH
1F1F 00        1730 +         DEFB 000H
1F20           1731           DEF03 02,A2,00,
1F20 02        1731 +         DEFB 002H
1F21 A2        1731 +         DEFB 0A2H
1F22 00        1731 +         DEFB 000H
1F23           1732           DEF03 02,AA,80,
1F23 02        1732 +         DEFB 002H
1F24 AA        1732 +         DEFB 0AAH
1F25 80        1732 +         DEFB 080H
1F26           1733           DEF03 00,AA,00,
1F26 00        1733 +         DEFB 000H
1F27 AA        1733 +         DEFB 0AAH
1F28 00        1733 +         DEFB 000H
1F29           1734           DEF03 00,A8,00,
1F29 00        1734 +         DEFB 000H
1F2A A8        1734 +         DEFB 0A8H
1F2B 00        1734 +         DEFB 000H
1F2C           1735           DEF03 15,55,00,
1F2C 15        1735 +         DEFB 015H
1F2D 55        1735 +         DEFB 055H
1F2E 00        1735 +         DEFB 000H
1F2F           1736           DEF03 55,55,50,
1F2F 55        1736 +         DEFB 055H
1F30 55        1736 +         DEFB 055H
1F31 50        1736 +         DEFB 050H
1F32           1737           DEF03 51,55,50,
1F32 51        1737 +         DEFB 051H
1F33 55        1737 +         DEFB 055H
1F34 50        1737 +         DEFB 050H
1F35           1738           DEF03 41,55,00,
1F35 41        1738 +         DEFB 041H
1F36 55        1738 +         DEFB 055H
1F37 00        1738 +         DEFB 000H
1F38           1739           DEF03 41,55,00,
1F38 41        1739 +         DEFB 041H
1F39 55        1739 +         DEFB 055H
1F3A 00        1739 +         DEFB 000H
1F3B           1740           DEF03 45,55,00,
1F3B 45        1740 +         DEFB 045H
1F3C 55        1740 +         DEFB 055H
1F3D 00        1740 +         DEFB 000H
1F3E 01        1741           DEFB 01H
1F3F 55        1742           DEFB 55H
1F40           1743  WAGPAT:  DEF04 0,0,4,16
1F40 00        1743 +         DEFB 00H
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

1F41 00        1743 +         DEFB 00H
1F42 04        1743 +         DEFB 04H
1F43 16        1743 +         DEFB 016H
1F44           1744           DEF04 00,05,50,00,
1F44 00        1744 +         DEFB 000H
1F45 05        1744 +         DEFB 005H
1F46 50        1744 +         DEFB 050H
1F47 00        1744 +         DEFB 000H
1F48           1745           DEF04 00,55,55,00,
1F48 00        1745 +         DEFB 000H
1F49 55        1745 +         DEFB 055H
1F4A 55        1745 +         DEFB 055H
1F4B 00        1745 +         DEFB 000H
1F4C           1746           DEF04 01,55,55,40,
1F4C 01        1746 +         DEFB 001H
1F4D 55        1746 +         DEFB 055H
1F4E 55        1746 +         DEFB 055H
1F4F 40        1746 +         DEFB 040H
1F50           1747           DEF04 05,55,55,50,
1F50 05        1747 +         DEFB 005H
1F51 55        1747 +         DEFB 055H
1F52 55        1747 +         DEFB 055H
1F53 50        1747 +         DEFB 050H
1F54           1748           DEF04 15,54,15,54,
1F54 15        1748 +         DEFB 015H
1F55 54        1748 +         DEFB 054H
1F56 15        1748 +         DEFB 015H
1F57 54        1748 +         DEFB 054H
1F58           1749           DEF04 15,50,05,54,
1F58 15        1749 +         DEFB 015H
1F59 50        1749 +         DEFB 050H
1F5A 05        1749 +         DEFB 005H
1F5B 54        1749 +         DEFB 054H
1F5C           1750           DEF04 15,40,01,54,
1F5C 15        1750 +         DEFB 015H
1F5D 40        1750 +         DEFB 040H
1F5E 01        1750 +         DEFB 001H
1F5F 54        1750 +         DEFB 054H
1F60           1751           DEF04 15,40,01,54,
1F60 15        1751 +         DEFB 015H
1F61 40        1751 +         DEFB 040H
1F62 01        1751 +         DEFB 001H
1F63 54        1751 +         DEFB 054H
1F64           1752           DEF04 15,50,05,54,
1F64 15        1752 +         DEFB 015H
1F65 50        1752 +         DEFB 050H
1F66 05        1752 +         DEFB 005H
1F67 54        1752 +         DEFB 054H
1F68           1753           DEF04 05,54,15,50,
1F68 05        1753 +         DEFB 005H
1F69 54        1753 +         DEFB 054H
1F6A 15        1753 +         DEFB 015H
1F6B 50        1753 +         DEFB 050H
1F6C           1754           DEF04 01,55,55,40,
1F6C 01        1754 +         DEFB 001H
1F6D 55        1754 +         DEFB 055H
1F6E 55        1754 +         DEFB 055H
```

```
ADDR OBJECT    STMT  LABEL   OPCD OPERAND        COMMENT

1F6F 40        1754 +        DEFB 040H
1F70           1755          DEF04 00,55,55,00,
1F70 00        1755 +        DEFB 000H
1F71 55        1755 +        DEFB 055H
1F72 55        1755 +        DEFB 055H
1F73 00        1755 +        DEFB 000H
1F74           1756          DEF04 00,15,54,00,
1F74 00        1756 +        DEFB 000H
1F75 15        1756 +        DEFB 015H
1F76 54        1756 +        DEFB 054H
1F77 00        1756 +        DEFB 000H
1F78           1757          DEF04 02,AA,AA,80,
1F78 02        1757 +        DEFB 002H
1F79 AA        1757 +        DEFB 0AAH
1F7A AA        1757 +        DEFB 0AAH
1F7B 80        1757 +        DEFB 080H
1F7C           1758          DEF04 00,AA,AA,00,
1F7C 00        1758 +        DEFB 000H
1F7D AA        1758 +        DEFB 0AAH
1F7E AA        1758 +        DEFB 0AAH
1F7F 00        1758 +        DEFB 000H
1F80           1759          DEF04 12,AA,AA,84,
1F80 12        1759 +        DEFB 012H
1F81 AA        1759 +        DEFB 0AAH
1F82 AA        1759 +        DEFB 0AAH
1F83 84        1759 +        DEFB 084H
1F84           1760          DEF04 10,A8,2A,04,
1F84 10        1760 +        DEFB 010H
1F85 A8        1760 +        DEFB 0A8H
1F86 2A        1760 +        DEFB 02AH
1F87 04        1760 +        DEFB 004H
1F88           1761          DEF04 10,20,08,04,
1F88 10        1761 +        DEFB 010H
1F89 20        1761 +        DEFB 020H
1F8A 08        1761 +        DEFB 008H
1F8B 04        1761 +        DEFB 004H
1F8C           1762          DEF04 52,AA,AA,85,
1F8C 52        1762 +        DEFB 052H
1F8D AA        1762 +        DEFB 0AAH
1F8E AA        1762 +        DEFB 0AAH
1F8F 85        1762 +        DEFB 085H
1F90           1763          DEF04 10,20,08,04,
1F90 10        1763 +        DEFB 010H
1F91 20        1763 +        DEFB 020H
1F92 08        1763 +        DEFB 008H
1F93 04        1763 +        DEFB 004H
1F94           1764          DEF04 10,00,00,04,
1F94 10        1764 +        DEFB 010H
1F95 00        1764 +        DEFB 000H
1F96 00        1764 +        DEFB 000H
1F97 04        1764 +        DEFB 004H
1F98           1765          DEF04 10,00,00,04,
1F98 10        1765 +        DEFB 010H
1F99 00        1765 +        DEFB 000H
1F9A 00        1765 +        DEFB 000H
1F9B 04        1765 +        DEFB 004H
               1766  ;
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

1F9C 00        1767. FUDG4:   DEFB 0
               1768  ;
1F9D           1769  MSET     MASTER 0A4
1F9D 80        1769 +         DEFB 80H
1F9E 11        1769 +         DEFB 0A4
1F9F           1770           VOLUME 09H,0H
1F9F B0        1770 +         DEFB 0B0H
1FA0 09        1770 +         DEFB 09H
1FA1 00        1770 +         DEFB 0H
1FA2 C9        1771           RET
               1772    ; HOME ON THE RANGE
1FA3 CD9D1F    1773  HOME     CALL MSET
1FA6           1774           NOTE1 36,G1
1FA6 24        1774 +         DEFB 36&7FH
1FA7 7E        1774 +         DEFB G1
1FA8           1775           NOTE1 12,F1
1FA8 0C        1775 +         DEFB 12&7FH
1FA9 8D        1775 +         DEFB F1
1FAA           1776           NOTE1 18,E1
1FAA 12        1776 +         DEFB 18&7FH
1FAB 96        1776 +         DEFB E1
1FAC           1777           NOTE1 6,D1
1FAC 06        1777 +         DEFB 6&7FH
1FAD A8        1777 +         DEFB D1
1FAE           1778           NOTE1 36,E1
1FAE 24        1778 +         DEFB 36&7FH
1FAF 96        1778 +         DEFB E1
1FB0           1779           QUIET
1FB0 F0        1779 +         DEFB 0F0H
               1780    ; TAPS
1FB1           1781  TAPS
1FB1 CD9D1F    1782           CALL MSET
1FB4           1783           NOTE1 18,C1
1FB4 12        1783 +         DEFB 18&7FH
1FB5 BD        1783 +         DEFB C1
1FB6           1784           NOTE1 6,C1
1FB6 06        1784 +         DEFB 6&7FH
1FB7 BD        1784 +         DEFB C1
1FB8           1785           NOTE1 36,F1
1FB8 24        1785 +         DEFB 36&7FH
1FB9 8D        1785 +         DEFB F1
1FBA           1786           NOTE1 18,C1
1FBA 12        1786 +         DEFB 18&7FH
1FBB BD        1786 +         DEFB C1
1FBC           1787           NOTE1 6,F1
1FBC 06        1787 +         DEFB 6&7FH
1FBD 8D        1787 +         DEFB F1
1FBE           1788           NOTE1 36,A1
1FBE 24        1788 +         DEFB 36&7FH
1FBF 70        1788 +         DEFB A1
1FC0           1789           QUIET
1FC0 F0        1789 +         DEFB 0F0H
               1790    ; FUNERAL
1FC1           1791  FUNERL
1FC1 CD9D1F    1792           CALL MSET
1FC4           1793           NOTE1 24,A0
1FC4 18        1793 +         DEFB 24&7FH
```

```
ADDR OBJECT    STMT  LABEL    OPCD OPERAND       COMMENT

1FC5 E1        1793 +         DEFB A0
1FC6           1794           NOTE1  18, A0
1FC6 12        1794 +         DEFB 18&7FH
1FC7 E1        1794 +         DEFB A0
1FC8           1795           NOTE1  6, A0
1FC8 06        1795 +         DEFB 6&7FH
1FC9 E1        1795 +         DEFB A0
1FCA           1796           NOTE1  24, A0
1FCA 18        1796 +         DEFB 24&7FH
1FCB E1        1796 +         DEFB A0
1FCC           1797           NOTE1  18, C1
1FCC 12        1797 +         DEFB 18&7FH
1FCD BD        1797 +         DEFB C1
1FCE           1798           NOTE1  6, B0
1FCE 06        1798 +         DEFB 6&7FH
1FCF C8        1798 +         DEFB B0
1FD0           1799           NOTE1  18, B0
1FD0 12        1799 +         DEFB 18&7FH
1FD1 C8        1799 +         DEFB B0
1FD2           1800           NOTE1  6, A0
1FD2 06        1800 +         DEFB 6&7FH
1FD3 E1        1800 +         DEFB A0
1FD4           1801           NOTE1  18, A0
1FD4 12        1801 +         DEFB 18&7FH
1FD5 E1        1801 +         DEFB A0
1FD6           1802           NOTE1  6, GS0
1FD6 06        1802 +         DEFB 6&7FH
1FD7 EE        1802 +         DEFB GS0
1FD8           1803           NOTE1  18, A0
1FD8 12        1803 +         DEFB 18&7FH
1FD9 E1        1803 +         DEFB A0
1FDA           1804           QUIET
1FDA F0        1804 +         DEFB 0F0H
1FDB           1805  GUNSHOT  OUTPUT 18H, 0F0H, 0F5H, 0FDH, 0FFH, 0, 3FH, 0FFH, 0EFH
               1805 +         IF     .NOT. (18H=18H)
               1805 +         ENDIF
               1805 +         IF     18H=18H
1FDB 88        1805 +         DEFB 88H
1FDC           1805 +         DEF8  0EFH, 0FFH, 3FH, 0, 0FFH, 0FDH, 0F5H, 0F0H
1FDC EF        1805 +         DEFB  0EFH
1FDD FF        1805 +         DEFB  0FFH
1FDE 3F        1805 +         DEFB  3FH
1FDF 00        1805 +         DEFB  0
1FE0 FF        1805 +         DEFB  0FFH
1FE1 FD        1805 +         DEFB  0FDH
1FE2 F5        1805 +         DEFB  0F5H
1FE3 F0        1805 +         DEFB  0F0H
               1805 +         ENDIF
1FE4           1806           LEGSTA
1FE4 E0        1806 +         DEFB  0E0H
1FE5           1807           VOLUME  0FFH, 03FH
1FE5 B0        1807 +         DEFB  0B0H
1FE6 FF        1807 +         DEFB  0FFH
1FE7 3F        1807 +         DEFB  03FH
1FE8           1808           REST  5
1FE8 E1        1808 +         DEFB  0E1H
1FE9 05        1808 +         DEFB  5
```

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ADDR OBJECT   STMT  LABEL   OPCD OPERAND      COMMENT

 1FEA          1809          NOTE1 5,8FH
 1FEA 05       1809 +        DEFB 5&7FH
 1FEB 8F       1809 +        DEFB 8FH
 1FEC          1810          NOTE1 5,4CH
 1FEC 05       1810 +        DEFB 5&7FH
 1FED 4C       1810 +        DEFB 4CH
 1FEE          1811          QUIET
 1FEE F0       1811 +        DEFB 0F0H
>1FEF          1812  LASTB   EQU  $



               1814  ; *************
               1815  ; * RAM CELLS *
               1816  ; *************
               1817          ORG  NORMEM+0E70H
 4E70          1818          DEFS 150         ; ALLOW BIG STACK
>4F06          1819  STACK   EQU  $           ; START STACK HERE
 4F06          1820          DEFS 12
>4F12          1821  MSTACK  EQU  $
>4F12          1822  STRRAM  EQU  $
 4F12          1823  WRITQ:  DEFS 3           ; WRITE Q HEADER
 4F15          1824  VECQ:   DEFS 3           ; VECTOR Q HEADER
>4F18          1825  VECSTR  EQU  $
 4F18          1826  BULV1:  DEFS BULVSZ      ; BULLET VECTOR 1
 4F2A          1827  BULV2:  DEFS BULVSZ      ; BULLET VECTOR 2
 4F3C          1828  BULV3:  DEFS BULVSZ      ; BULLET VECTOR 3
 4F4E          1829  BULV4:  DEFS BULVSZ      ; BULLET VECTOR 4
 4F60          1830          DEFS 1           ; LEFT COWBOY LINK
 4F61          1831  LCOWB:  DEFS GFVSIZ-1    ; LEFT GUNFIGHTER
 4F77          1832          DEFS 1           ; RIGHT COWBOY LINK
 4F78          1833  RCOWB:  DEFS GFVSIZ-1    ; RIGHT GUNFIGHER
 4F8E          1834          DEFS 1           ; WAGON LINK
 4F8F          1835  WAGVEC: DEFS WAGVSZ      ; WAGON VECTOR
>4F90          1836  WAGON   EQU  WAGVEC+VBSTAT
>4FA1          1837  ENDRAM  EQU  $
>4FDA          1838  LBULS   EQU  CT5
>4FDB          1839  RBULS   EQU  CT6
 4FA1          1840  RFIELD  DEFS 1
 4FA2          1841  LSCORE  DEFS 3
 4FA5          1842  LFIELD  DEFS 1
 4FA6          1843  RSCORE  DEFS 3
               1844          LIST S
>1FEF          1845  LEND    EQU  LASTB
 4FA9          1846          END

TOTAL ASSEMBLER ERRORS =
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CROSS REFERENCE

LABEL	VALUE	REFERENCE						
A0	00E1	-508	1794	1795	1796	1797	1801	1802	1804
A1	0070	-520	1789						
A2	0037	-532							
A3	001B	-544							
A4	000D	-556							
A5	0006	-562							
ACTINT	000E	-225							
ADDTQ	1D54	-1355	1110	1274	1423	1441			
ADDTQ1	1D68	-1372	1482						
ALINE	0009	-676	1053	1055	1055	1531			
ALKEYS	0214	-49	1180						
ARM0	1DFC	-1479	1569						
ARM1	1E0A	-1479	1570						
ARM2	1E14	-1479	1571						
ARM3	1E1C	-1479	1572						
ARM4	1E28	-1479	1573						
ARM5	1E36	-1479	1574						
ARM6	1E46	-1479	1575						
ARMTBL	1DDB	-1439	1255						
AS0	00D4	-509							
AS1	006A	-521							
AS2	0034	-533							
AS3	001A	-545							
B0	00C8	-510	1799	1800					
B1	0064	-522							
B2	0031	-534							
B3	0018	-546							
BCACY	0046	-667	668						
BCDADD	0062	-277							
BCDCHS	006A	-281							
BCDDIV	0068	-280							
BCDMUL	0066	-279							
BCDNEG	006C	-282							
BCDSUB	0064	-278							
BEGINT	1B61	-1132							
BEGRAM	4FCE	-594							
BELP	1859	-773	785						
BERASE	183A	-756	757						
BITSPL	00A0	-43							
BLANK	002A	-243	1148	1169					
BLINE	005C	-677	1031	1055	1520	1526	1532		
BMUSIC	0012	-229	814	814	937	937	1037		
BORG	1AAD	-1064	1111						
BOTLIN	0000	-685	1347						
BSY	0002	-656	713	771	1063	1069	1155		
BTREEY	0041	-668							
BULLMT	1D8F	-1410	868	1355					
BULLP	1AB9	-1068	1131						
BULRIT	1B57	-1125	1159	1165					
BULT	000B	-1429	1156						
BULTAB	1D93	-1420	792						
BULV1	4F18	-1541	728	1121	1186	1291	1304	1353	
BULV2	4F2A	-1542							

BULV3	4F3C	-1543	734						
BULV4	4F4E	-1544							
BULVSZ	0012	-679	744	1120	1187	1292	1336	1356	1826
		1827	1828	1829					
BYTEPL	0028	-42	1053	1055	1055				
C1	00BD	-511	1784	1785	1787	1798			
C2	005E	-523							
C3	002E	-535							
C4	0017	-547							
C5	000B	-557							
C6	0005	-563							
C7	0002	-566							
CACTUS	1EF8	-1499	949	1118					
CACW	19C8	-953	958	964	972	981			
CBA	0009	-123							
CBB	0007	-121	735						
CBC	0006	-120							
CBD	0005	-119							
CBE	0004	-118							
CBFLAG	0008	-122							
CBH	000B	-125							
CBIXH	0003	-117							
CBIXL	0002	-116							
CBIYH	0001	-115							
CBIYL	0000	-114							
CBL	000A	-124							
CCACX	004C	-671	877	1115					
CHDOWN	0001	-111							
CHLEFT	0002	-110							
CHRDIS	0032	-248	1154	1164	1221	1222	1223	1224	1225
CHRIGH	0003	-109							
CHTRIG	0004	-108							
CHUP	0000	-112							
CNT	4FDD	-611							
COL0L	0004	-168							
COL0R	0000	-164							
COL1L	0005	-169							
COL1R	0001	-165							
COL2L	0006	-170							
COL2R	0002	-166							
COL3L	0007	-171							
COL3R	0003	-167							
COLBX	000B	-172							
COLLST	4FE8	-622							
COLSET	0018	-234	1035						
CONCM	0008	-189							
COWINT	1D34	-1344	1097	1100					
COWX	0060	-673							
CS1	00B2	-512							
CS2	0059	-524							
CS3	002C	-536							
CS4	0015	-548							
CS5	000A	-558							
CT0	4FD5	-602							
CT1	4FD6	-603							
CT2	4FD7	-604							
CT3	4FD8	-605							

CT4	4FD9	-606					
CT5	4FDA	-607	1048	1838			
CT6	4FDB	-608	1839				
CT7	4FDC	-609	708	716	758	763	1025
CTIMER	0203	-46					
D1	00A8	-513	1778				
D2	0054	-525					
D3	0029	-537					
D4	0014	-549					
DABS	0072	-285					
DADD	006E	-283					
DCLOCK	17E1	-704	1219				
DCOUT	17F7	-713	710				
DEATH	1B10	-1113					
DECCTS	0010	-226	706	706			
DELQ	1D29	-1335	1239	1370	1438		
DIE	1930	-881	895				
DIE1	194C	-892	909				
DIE4	1963	-900	922				
DIFER	4FFF	-1213					
DISNUM	0036	-250	712	712	1062	1068	
DISTIM	0052	-267					
DLEFT	1942	-888	902				
DOIT	0044	-260	1182				
DOITB	0046	-261					
DRAW	1D8B	-1408	1153				
DRX	0040	-663	1153				
DS1	009F	-514					
DS2	004F	-526					
DS3	0027	-538					
DS4	0013	-550					
DS5	0009	-559					
DS6	0004	-564					
DSMG	0070	-284					
DTAB	1B38	-1133	1182				
DURAT	4FEA	-624					
E1	0096	-515	1777	1779			
E2	004A	-527					
E3	0025	-539					
E4	0012	-551					
EIRE	1BBE	-1167					
ELOP	1917	-866	892				
EMUSIC	0014	-230					
END	00C0	-379	1219	1219			
ENDGAM	1B30	-1130	1075				
ENDRAM	4FA1	-1552	1057				
ENDRND	1B2C	-1128	1210	1211			
ENDSCR	4FF4	-632	1020				
ERASE	190A	-861	898	900			
F1	008D	-516	1776	1786	1788		
F2	0046	-528					
F3	0022	-540					
F4	0011	-552					
F5	0008	-560					
FIELD	1988	-917	1084	1088			
FILL	001A	-235	1024	1053	1055	1057	
FIREO	17FF	-720	1217				

FIRE1	180A	-724	1218		
FIRST	1D6B	-1379	1238	1341	1368
FIRSTC	2000	-40			
FNTSML	020D	-48	707	1060	1144
FNTSYS	0206	-47			
FS1	0085	-517			
FS2	0042	-529			
FS3	0020	-541			
FS4	0010	-553			
FTBASE	0000	-93			
FTBYTE	0003	-96			
FTFSX	0001	-94			
FTFSY	0002	-95			
FTPTH	0006	-99			
FTPTL	0005	-98			
FTYSIZ	0004	-97			
FUDG4	1F9C	-1519			
FUNERL	1FC1	-1528	914		
G0	00FD	-506			
G1	007E	-518	1775		
G2	003E	-530			
G3	001F	-542			
G4	000F	-554			
G5	0007	-561			
G6	0003	-565			
G7	0001	-567			
G8	0000	-568			
GAMSTB	4FF8	-634	1029	1204	
GETNUM	004E	-265			
GETPAR	004C	-264	1018	1018	
GETRDY	1D7E	-1402	1077		
GFBODY	1F10	-1516	1264		
GFCOLS	1DC7	-1420	1035		
GFLFR	1BC5	-1174	1516		
GFVSIZ	0017	-680	1296	1831	1833
GFWRIT	1B5D	-1129	1517		
GFWRT1	1BA4	-1160	1243		
GFWRT2	1BAC	-1161	1265	1281	
GFWRT3	1BB4	-1162			
GFWRT4	1BAE	-1160			
GFWRT5	1BC0	-1169	1254		
GOTME	1F06	-1511	938		
GRX	002C	-661	1077		
GRY	0001	-662	1077	1153	
GS0	00EE	-507	1803		
GS1	0077	-519			
GS2	003B	-531			
GS3	001D	-543			
GS4	000E	-555			
GSBEND	0007	-62	1205		
GSBSCR	0001	-61	1028		
GSBTIM	0000	-60			
GTMINS	4FEE	-628			
GTSECS	4FED	-627			
GUNLMT	1D87	-1404	1394		
GUNSHO	1FDB	-1530	816		
GVEC3A	1CDD	-1296	1386	1391	

OPOT3	4FE2	-616						
OSW0	4FE4	-618						
OSW1	4FE5	-619						
OSW2	4FE6	-620						
OSW3	4FE7	-621						
PAWS	0050	-266	942	942	1142	1142	1167	
PIZBRK	0048	-262	820					
PJOY	1899	-812	823					
POT0	001C	-201						
POT1	001D	-202						
POT2	001E	-203						
POT3	001F	-204						
PPOT	18BE	-826	838					
PPOT0	18B9	-823	1212					
PPOT1	18B1	-819	1213					
PRIOR	4FF9	-635						
PSWCY	0000	-58						
PSWPV	0002	-57						
PSWSGN	0007	-55						
PSWZRO	0006	-56						
PUTVEC	19D3	-961	804	810				
PVOLAB	4FD2	-598						
PVOLMC	4FD3	-599						
QUIT	0078	-288	1208	1208				
RANGED	0076	-287						
RANSHT	4FEF	-630						
RBULS	4FDB	-1554	733					
RBULX	0068	-659	771	1162				
RCACX	0058	-670	673	872	894	899	1032	1082
RCALL	0004	-218	1075					
RCOWB	4F78	-1548	732	824	835	912	1098	
RECTAN	001C	-236						
RELAB1	003A	-253	780	780	882	882		
RELABS	0038	-252	1321	1321				
RESTOR	002E	-245						
RFIELD	4FA1	-1555	1081					
RFTAB	1DC2	-1420	1083					
RITB	184F	-769	774					
RNX	0088	-657	1068					
RSCORE	4FA6	-1558	908	1072				
SAVE	002C	-244						
SCHEDR	000C	-224						
SCREEN	0000	-41	1324	1326				
SCROLL	0030	-246						
SCRSTR	0016	-232						
SCT0	0001	-128						
SCT1	0002	-129						
SCT2	0003	-130						
SCT3	0004	-131						
SCT4	0005	-132						
SCT5	0006	-133						
SCT6	0007	-134						
SCT7	0008	-135	1210					
SEMI4S	4FDE	-612	944	1195				
SENFLG	4FFA	-636						
SENTRY	0042	-259	1180					
SETB	007A	-289	1028					

SETOUT	0016	-233	1031						
SETW	007C	-290							
SF0	0009	-136	1211						
SF1	000A	-137							
SF2	000B	-138							
SF3	000C	-139							
SF4	000D	-140							
SF5	000E	-141							
SF6	000F	-142							
SF7	0010	-143							
SHIFTU	0060	-276							
SINIT	1DCF	-1428	1050						
SJ0	0015	-152	1214						
SJ1	0017	-154	1215						
SJ2	0019	-156							
SJ3	001B	-158							
SKYD	0013	-145	1216						
SKYU	0012	-146							
SNDBX	0018	-184							
SNUL	0000	-127							
SP0	001C	-147	1212						
SP1	001D	-148	1213						
SP2	001E	-149							
SP3	001F	-150							
SSEC	0011	-144	1219						
ST0	0014	-151	1217						
ST1	0016	-153	1218						
ST2	0018	-155							
ST3	001A	-157							
STACK	4F06	-1534	1021	1024	1025				
STHN	18A4	-814							
STIMER	0200	-45	1427						
STMRX	004C	-660	712						
STOREN	0058	-272							
STRDIS	0034	-249	941	941	1077	1153			
STRND	1A0C	-1001	1202						
STRRAM	4F12	-1537	1057	1057					
STSEC	1837	-755	761						
SUCK	000C	-222	725	725	731	731	904	904	911
		911	1059	1161					
SW0	0010	-197							
SW1	0011	-198							
SW2	0012	-199							
SW3	0013	-200							
SYSRAM	4FCE	-639							
TAPS	1FB1	-1525	907						
TBUMP	1D1E	-1325	1294	1298	1450				
TBUMP1	1D25	-1330	1447						
TCAC	199B	-927	957						
TCACY	0014	-664	665						
TIME	000B	-1430	714	1064	1070				
TIMOUT	4FEC	-626							
TIYU	1ABE	-1071	1125						
TLINE	000A	-675	676	921	1109	1519	1525		
TMR60	4FEB	-625							
TONEA	0011	-177							
TONEB	0012	-178							

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GVEC3B     1CEC          -1302   1415
GVECT      1C79          -1253   1425
GVECT1     1CB5          -1279   1377   1383
GVECT2     1CC4          -1283   1396
GVECT3     1CDA          -1294   1402
GVECT4     1CFC          -1309   1369   1442
GVECT5     1D07          -1318   1374
GVECT6     1D12          -1320   1420
HIT        18E6           -847    856
HIT1       18FB           -853    865
HIT2       1920           -874    873
HITCHK     18CE           -837   1191
HOME       1FA3          -1523   1039
HORAF      000F           -195
HORCB      0009           -173
HUMANR     0040           -257
INCSCR     0054           -268    926    926
INDEXB     005C           -274
INDEXN     0056           -271
INDEXW     005A           -273
INFBK      000D           -186   1137   1234   1344
INIT       19E8           -983    644
INITQ      1A5E          -1036
INLIN      000F           -188   1236   1350
INMOD      000E           -187
INTPC      0000           -216    706    712    725    731    780    814    830
                           870    882    904    911    926    937    941    942
                           991   1018   1023   1023   1023   1046   1046   1046
                          1115   1142   1146   1146   1146   1179   1179   1179
                          1208   1247   1252   1264   1269   1271   1321   1360
                          1396   1437
INTP@      0000           -986   -998  -1002  -1024  -1087  -1105  -1109  -1111
                         -1128
INTST      0008           -193
INTTBL     1D78          -1396   1133
JOY0       188F           -808   1214
JOY1       1895           -810   1215
KART       18CA           -834    848
KCTASC     0040           -258
KEY0       0014           -206
KEY1       0015           -207
KEY2       0016           -208
KEY3       0017           -209
KEYSEX     4FE3           -617
KIL1       1E84          -1495    917
KIL2       1ED6          -1497   1676   1698
LARG2      000C          -1432    937
LARGE      000B          -1431   1077   1153
LASTB      1FEF          -1527   1845
LBULS      4FDA          -1553    727
LBULX      0020           -658   1154
LCACX      0040           -669    896   1086   1524
LCOWB      4F61          -1546    726    822    839    905   1090   1094
LEG0       1E4F          -1489   1247   1388   1405   1470   1668
LEG1       1E64          -1491   1652
LEG2       1E74          -1493   1660
LEND       1FEF          -1560
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LFIELD	4FA5	-1557	1085					
LFRLIN	00C8	-686	1235					
LFRVEC	1D78	-1397	1136	1233				
LFTAB	1DBD	-1420	1087					
LNX	0008	-655	1062					
LOOP	1B07	-1109	1197	1199				
LPPP2	1B19	-1116	1198					
LSCORE	4FA2	-1556	915	1066				
MAGIC	000C	-190	718	1311				
MATH	0056	-270						
MCAC	19A6	-933	963					
MCACY	002A	-666	1116					
MCALL	0006	-219	1159	1165				
MENU	004A	-263						
MENUST	0218	-50						
MIDC	1AA2	-1058	1103					
MJUMP	000A	-221						
MOVE	005E	-275	1048					
MRET	0008	-220	821	1226				
MRFLOP	0006	-101	772	897	901			
MRLOCK	4FF7	-633						
MROR	0004	-103						
MRROT	0002	-105						
MRSHFT	0003	-106						
MRXOR	0005	-102						
MRXPND	0003	-104						
MSET	1F9D	-1521	1773	1782	1792			
MSKTD	007E	-291	830	830				
MSTACK	4F12	-1536	814	934	1037			
MUZAK	0012	-228						
MUZPC	4FCE	-596						
MUZSP	4FD0	-597						
MXSCR	021E	-51	1018					
NBRK	188D	-807	1216					
NEGT	0074	-286						
NEXT	FFFF	-688	1455	1477				
NOGAME	0235	-53						
NOPLAY	0228	-52						
NORMEM	4000	-39	1053	1055	1324	1326	1817	
NULPAT	1F0C	-1512	1280					
NUMB	0007	-1428						
NUMPLY	4FF3	-631						
NWHDWR	0001	-36						
OA1	008F	-576						
OA2	0047	-577						
OA3	0023	-578						
OA4	0011	-579	1770					
OA5	0008	-580						
OB0	00FE	-570						
OC0	00F1	-571						
OD1	00D6	-572						
OE1	00BF	-573						
OF1	00B4	-574						
OG1	00A0	-575						
OPOT0	4FDF	-613						
OPOT1	4FE0	-614						
OPOT2	4FE1	-615						

TONEC	0013	-179							
TONMO	0010	-176							
TOPLIN	006A	-684	1349						
TREE	1DE9	-1462	976						
TTREEY	000F	-665							
UMARGT	4FFB	-637							
UPISTR	0000	-215							
USERTB	4FFD	-638							
VBARM	000F	-689	690	787	850	1257	1310	1323	1413
		1469							
VBBLNK	0006	-87	1306	1313	1334				
VBCCHK	0004	-84							
VBCH	0003	-83							
VBCL	0002	-82							
VBCLAT	0003	-91	858	1360					
VBCLMT	0000	-89							
VBCOMP	0013	-693							
VBCREV	0001	-90							
VBDCH	0001	-81							
VBDCL	0000	-80							
VBDXH	0004	-68	832	1380					
VBDXL	0003	-67	833	1379	1463				
VBDYH	0009	-73	830	1382					
VBDYL	0008	-72	831	1107	1381				
VBLANK	0028	-242	1247	1247	1269	1269			
VBLEG	0012	-692	693	917	1248	1388	1404	1407	1470
VBLEGT	0011	-691	692	916	1400	1411			
VBMR	0000	-64	772	826	897	901	1095	1099	1105
		1127	1319						
VBOAH	000E	-78	689	1271	1308	1321			
VBOAL	000D	-77	1272	1309	1322				
VBOARM	0010	-690	691	1414	1417				
VBSACT	0007	-86	1315	1332	1357	1362			
VBSCHG	0003	-696	1389	1397	1410	1416	1419	1439	
VBSINT	0005	-698	1253	1333	1376				
VBSNOM	0004	-697	1385	1390	1398				
VBSTAT	0001	-65	853	860	867	871	918	1242	1253
		1291	1306	1313	1315	1332	1333	1334	1357
		1362	1373	1376	1385	1389	1390	1397	1398
		1410	1416	1419	1439	1464	1836		
VBSWAG	0000	-695	1242	1373					
VBTIMB	0002	-66	866	1384					
VBXCHK	0007	-71	858	861	1128	1360	1465		
VBXH	0006	-70	863	1108	1318	1467			
VBXL	0005	-69							
VBYCHK	000C	-76	1106	1129	1466				
VBYH	000B	-75	879	919	1109	1317	1345	1468	
VBYL	000A	-74							
VECQ	4F15	-1539	1092	1096	1273	1367	1422	1437	
VECSTR	4F18	-1540							
VECT	003E	-255	870	870	1360	1360	1396	1396	1437
		1437							
VECTC	003C	-254							
VERAF	000E	-194							
VERBL	000A	-174							
VIBRA	0014	-180							
VOICES	4FD4	-600							

VOLAB	0016	-181						
VOLC	0015	-182						
VOLN	0017	-183						
VWRITR	001E	-237	1252	1252	1264	1264	1271	1271
WAGLMT	1D7C	-1400	1435					
WAGON	4F90	-1551	874	970	1079	1101		
WAGPAT	1F40	-1518	1269					
WAGVEC	4F8F	-1550	1104	1836				
WAGVSZ	0012	-681	1835					
WAGX	0048	-672	864					
WALK	1AD5	-1085						
WASTE	0FFF	-585	719	1241	1302	1326		
WASTER	0FFF	-586						
WINBND	0032	-683	1346					
WRBL5A	1C52	-1240	1342					
WRBUL1	1BE9	-1195	1338					
WRBUL2	1C00	-1204	1307					
WRBUL3	1C2D	-1221	1331					
WRBUL4	1C31	-1223	1316					
WRBUL5	1C4F	-1237	1348					
WRBUL6	1C5E	-1244	1364					
WRBUL7	1C70	-1248	1358	1361				
WRIT	0024	-240						
WRITA	0026	-241						
WRITP	0022	-239	991	991	1115	1115		
WRITQ	4F12	-1538	1091	1237	1340	1440		
WRITR	0020	-238						
WRTVEC	1D7A	-1398	1343					
XINTC	0002	-217	1041	1078	1174	1184	1202	
XPAND	0019	-191	952	979	1113			
XPNDON	0001	-35						
ZOK	1828	-745	743	748				
ZORE	1813	-727	729					